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THE REPRESENTATION OF THE LIMITS OF THE VISUAL FIELD.

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(*With five wood-cuts.*)

Translated by Dr. J. B. McMahon, New York.

THE determination of the boundaries of the visual field has long been the object of scientific study. Ptolemy [1] was the first to investigate the subject. In later times, it attracted the attention of Thomas Young, Wollaston, Purkinje, and others. But it was reserved for v. Graefe to recognize the value of the measurement of the field of vision, as an important aid in the diagnosis of pathological conditions.

For the mapping of the visual field, A. v. Graefe employed a blackboard provided with a scale in four meridians. The patient was placed before it, with one eye covered and the gaze of the other fixed on a white point which marked the centre of the board.

The examiner slowly moved a piece of chalk on a black handle from the periphery to the centre, and noted the point at which the chalk became visible.

This was done with the successive meridians on the board, the points so obtained were joined by straight lines, and a copy of this diagram of the visual field could be made on a reduced scale and appended to the patient's history.

This is even now, as we shall show farther on, the best method for registering the field of vision. [2]

[1] S. Arago, "Astronomie" Bd. i, page 145.

[2] We fail to see that the author has succeeded in demonstrating the superiority

Later, Aubert [1] employed in his own physiological investigations, a new instrument for measuring the visual field, the perimeter, which was then introduced into ophthalmic practice by Förster.

The construction and use of this instrument are well known; in its original form it is pictured in Aubert's "Physiologie der Netzhaut," p. 116, fig. 19.

More recently, improved forms of the perimeter have been devised. The hemispherical perimeter of Scherk may be regarded as the best type of the improved instrument. On account of the greater ease of manipulation and the more truthful appearance of the visual fields registered by it, it is far superior to the instruments of Aubert and Förster, which, for distinction, we will call the bow-perimeter.

If, now, the visual field, as determined with the perimeter (of any form whatever), is to be represented on paper, a chart is employed consisting of a series of concentric circles. As, however, the interval between any one circle and the adjoining ones is constant, it is self-evident that such a chart does not give a correct picture of the real field of vision. In order to obviate this difficulty, Hirschberg designed charts [2] in which the concentric circles had foreshortened radii; although these are much better than those mentioned above, they are still defective, as can be proved by a simple geometrical construction.

The fields of vision mapped out on the board, and which can be regarded as central projections on the tangent plane to the perimeter at its pole, are entirely free from such errors. The importance of the angles of the boundary of the visual field, which are read from the perimeter without

of Graefe's method over Aubert-Förster's. Both furnish reliable, of course the same, results. Graefe's method is very convenient for the determination of a contracted visual field, but is deficient for determining fields of normal or inconsiderably reduced extent. No blackboard is large enough to receive the temporal limit of a normal F, which is about 90°, its tangent therefore infinite. The tracings on a sphere have an inestimable advantage over those on a plane by furnishing figures proportionate to the area of the retina, while those on a plane do so only for a small space near the point of fixation, viz., so far as the tangent does not materially differ from the arc. Compare a valuable paper on this subject by Hirschberg in these ARCHIVES, vol. iv, p. 366. KNAPP.

[1] Aubert, "Physiologie der Netzhaut," Breslau, 1865.

[2] Can be procured from P. Dörffel, Berlin.

trouble, is self-evident, and a table of these angles is sufficient in case one does not wish the representation of the field.

If, however, the entire visual field is given, drawn on the board, the reader has, first, a clear and correct picture of its boundary, and he can, if he so desire, compute with ease the value of the angles, provided, as is usual, the distance of the fixing eye from the centre of the chart is also given.

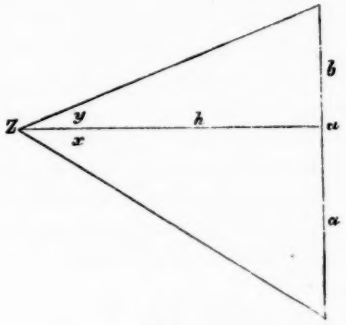

FIG. 1.

In Fig. 1[1] let Z represent the position of the eye, which is fixed on the centre of the chart α. Let h be the distance between these points, a and b the distances from the point of fixation to the boundary of the field of vision in one meridian, and x and y the corresponding angles. Then we have

$$\tan x = \frac{a}{h} \quad . \quad . \quad . \quad . \quad (1)$$

$$\tan y = \frac{b}{h} \quad . \quad . \quad . \quad . \quad (2)$$

Should one desire the value of the angle $x + y = z$, as, for example, in eccentric fixation, a simple formula suffices:

$$\tan Z = \frac{\sin Z}{\cos Z} = \frac{\sin x \cos y + \sin y \cos x}{\cos x \cos y - \sin x \sin y}$$

[1] Compare R. Hilbert, das Verhalten der Farbenblinden gegenüber den Erscheinungen der Fluorescenz, Königsberg, 1882, page 53, Anm. 2.

Dividing the numerator and denominator of this fraction by $\cos x \cos y$, we obtain

$$\tan Z = \frac{\tan x + \tan y}{1 - \tan x \tan y} = \frac{\frac{a}{h} + \frac{b}{h}}{1 - \frac{ab}{h^2}}$$

Multiplying the numerator and denominator of this fraction by h^2, we obtain

$$\tan Z = \frac{ah + bh}{h^2 - ab} = \frac{h\,(a+b)}{h^2 - ab} \quad . \quad . \quad (3)$$

Formulæ (1) and (2) can also be employed to construct a visual field on a chart from a given set of angles, or, which is the same thing, to convert one drawn on a perimetric chart into one drawn by central projection on the tangent plane passing through the pole of the perimeter.

But even in the most detailed perimetric determinations, and without a corresponding diagram, can the projection of every point be computed in any meridian.

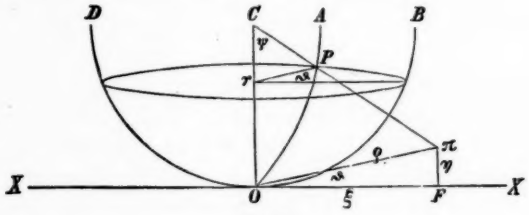

FIG. 2.

Fig. 2 represents a section through the perimeter and the tangent plane of projection passing through its pole. The plane of intersection passes through the pole O, and is perpendicular to the projection plane XX. Let P on the meridian AO be a point of the visual field to be projected on the plane XX. The line of projection passing through the centre C cuts the plane XX at π. The coördinates of π are to be found in terms of the known quantities, viz.: the radius of the perimeter r, the latitude $< \psi$, and the longitude $< \vartheta$, considering BO as the initial meridian.

Let O be the origin of the system of coördinates, XX the

axis of abscissas, the axis of ordinates a line perpendicular to XX at O, and in the plane of projection. Let the distance of the point π from the origin be ρ. Let fall a perpendicular πF from π on XX, then let the abscissa $OF = \xi$, and the ordinate $\pi F = \eta$. In the right-angled triangle $OF\pi$, ξ and η are easily determined.

$$\xi = \rho \cos \vartheta$$
$$\eta = \rho \sin \vartheta$$

The value of ρ is found in the right-angled triangle $OC\pi$

$$\rho = r \tan \psi$$

Substituting the value of ρ in the above equations, we obtain

$$\xi = r \tan \psi, \cos \vartheta \quad . \quad . \quad . \quad (4)$$
$$\eta = r \tan \psi, \sin \vartheta \quad . \quad . \quad . \quad (5)$$

To show the dissimilarity between the visual field mapped out on the board and that drawn upon a perimetric chart, I append the field of a male patient, fifty years old, suffering from atrophy of the optic nerve, whose right eye is already amaurotic. Fig. 3 represents the visual field of the left eye,

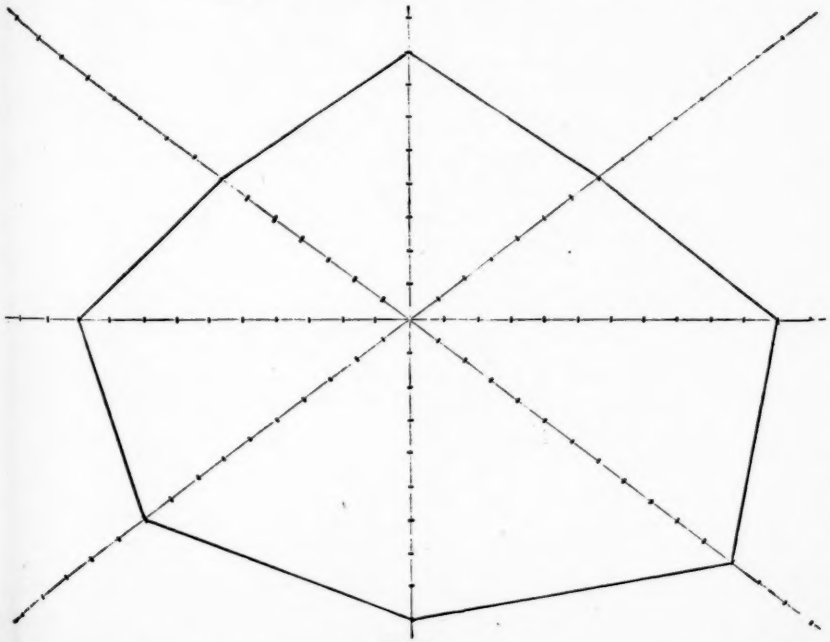

FIG. 3.

mapped out on the board. Fig. 4 shows the same as obtained with the perimeter.

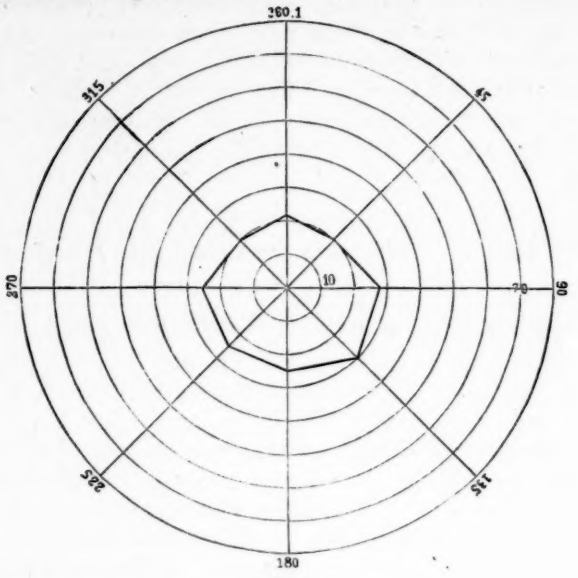

FIG. 4.

From the former, by means of formulæ (1) and (2), the angles corresponding to the different meridians were computed and entered on a perimetric chart. Fig. 5.

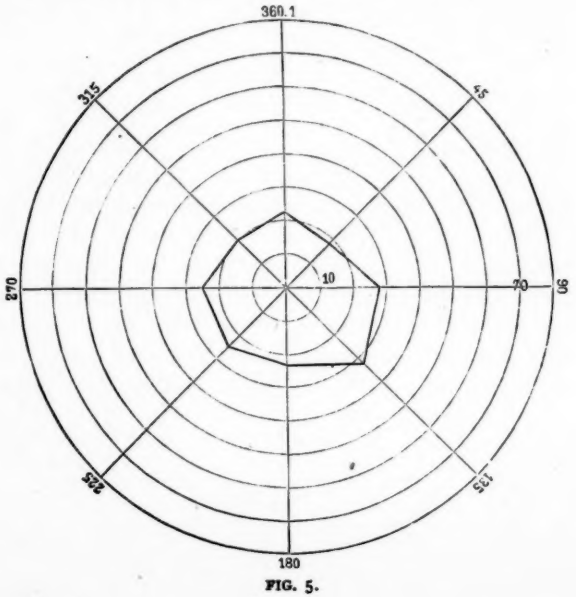

FIG. 5.

A comparison of figs. 4 and 5 shows plainly the marked agreement between the visual fields, the one determined by observation, the other by computation.

There is no object in making the optic papilla the centre of the field. The reason generally given for this displacement, that the papilla is usually regarded as the centre in ophthalmoscopic examinations, is not valid. In the ophthalmoscopic atlas of Jaeger, the best that ophthalmological literature possesses, we find the centre of the picture to be almost always the location of the macula lutea, while it is the optic papilla only in the few cases in which the disease is localized mainly in this situation. The macula lutea is certainly the physiological and natural centre of the field of vision. This serves as an answer to the question started by Förster[1] as to the representation of the visual field.

We can sum up the results of the above work as follows:

(1) Visual fields mapped out on the board are the most serviceable to practitioners.

(2) A perfectly correct representation of the configuration of the visual field is possible only when it is registered on the perimeter of Scherk.

(3) The visual fields entered on perimetric charts are distortions.

(4) The angles belonging to a visual field mapped out on the board are computed without difficulty.

(5) A visual field given by a list of its angles admits an easy construction of its surface-projection.

(6) The projection of the macula lutea should be the centre of the field of vision.

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[1] Offener Brief an Herrn Professor Hirschberg, *Centralblatt für practische Augenheilkunde*, 1883, Januarheft, pag. 31.

CHARACTER OF THE FOCAL LINES IN ASTIGMATISM.

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IT is common with writers on astigmatism to speak of the anterior and posterior focal *planes*, meaning by these the planes passing through the foci of the principal meridians. To the use of these terms no exceptions can be taken when they are limited in their application to the planes passing through the points mentioned. When, however, the focal planes are considered, as they undoubtedly are by many, as synonymous with planes passing through the focal *lines*, the terms are misapplied.

I think the error has arisen from experimental attempts to demonstrate the character of refraction by an asymmetrical surface. One of the simplest as well as the commonest of these methods is the combination of a cylindrical and a spherical lens. This, indeed, makes an astigmatic system, inasmuch as there is no place where all the rays emanating from any point are united after refraction; and in such experiments the anterior and posterior focal lines do correspond approximately with the planes passing through the foci of the meridians of the greatest and least refraction. This is so because the two principal meridians are regularly curved surfaces subject to only the ordinary amount of monochromatic aberration.

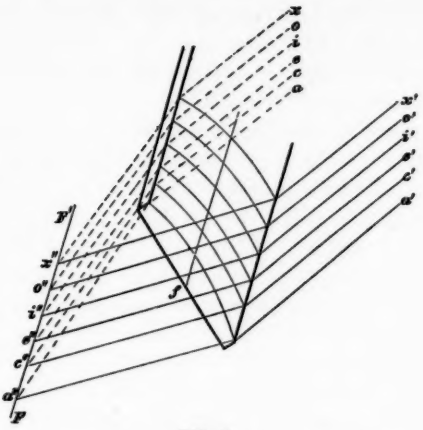

FIG. 1.

If the cylindrical lens acted alone we would have a series of foci on a right line parallel to the axis of the cylinder, as shown in Fig. 1. Each set of parallel rays *a a'*, *c c'*, etc., are united after refraction, each in its own plane perpendicular to the axis of the cylinder *f*, at the points *a''*, *c''*, etc., on the line *F F'* parallel to the axis *f*. The rays passing through the cylinder parallel to *f* would of course suffer no refraction. When, however, a positive spherical lens is united to this cylinder, it has the effect of uniting those rays passing through the cylinder in planes parallel to its axis *f*, and of advancing the focal line *F F'*, forming the well-known focal interval of Sturm, bounded by the anterior and posterior focal *lines*. In this instance these lines are approximately *straight*, because the surfaces of both the cylinder and the spherical lens are regularly curved, and the difference between the refraction of the central and peripheral meridians is expressed by the usual amount of spherical aberration. That is to say, there would be a slight curving of the focal lines; their concavity being toward the refracting surfaces.

The conditions are by no means the same when we come to deal with an ellipsoid of three unequal axes, such as is represented by the cornea in regular astigmatism. Here each of the meridians is not a regularly curved surface, but a surface which changes its curve at each successive point. No

such lenses, so far as my knowledge extends, have been used in making these experiments.

It is very easy, however, to picture in the mind's eye the conditions we should have in refraction by such a surface. We can suppose, as Dr. W. C. Ayres suggests,[1] that the ellipsoid is cut into a series of adjacent planes parallel to one of the principal meridians. Each of these planes will then represent, as does the principal meridian to which it is parallel, an ellipse. This is shown in *V*, Fig. 2, where the ellipsoid is supposed to be cut into a series—1, 2, 3, 4, 5, 6, etc.—of ellipses parallel to the principal vertical meridian *v a v'*.

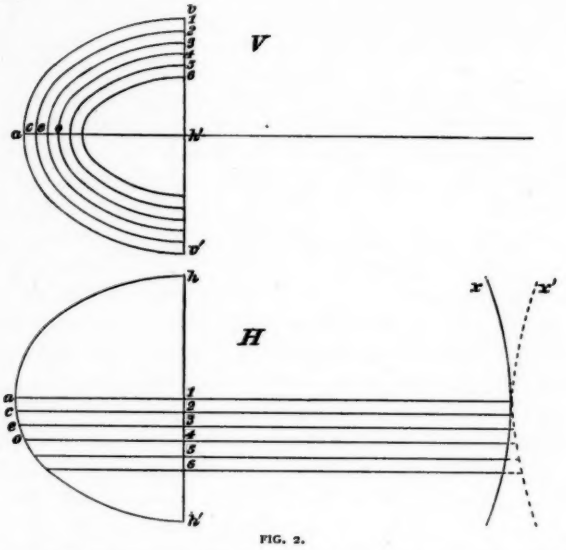

FIG. 2.

It must be evident, when we consider the form and the relations of these ellipses to each other, that there will have to be a wonderful combination of happy circumstances if we are to have the foci of rays refracted by all to lie in the same vertical plane.

That the foci all lie in the same *horizontal* plane is certain, because the apices of the ellipses, *c*, *e*, *o*, (which are

[1] *N. Y. Med. Journ.*, Nov., 1881.

the principal points of the refracting surfaces,) all lie in the same plane *a h'*, as the apex *a* of the ellipse 1, which represents the principal meridian with which they are parallel; and since all the cardinal points must lie in the same plane the foci must be found somewhere on the prolongation of the plane passing through *a h'*.

But it is also very evident that the principal points do not lie in the same *vertical* plane, for the apices, *a*, *c*, *e*, *o*, of the several ellipses, 1, 2, 3, etc., form part of a curved line which constitutes the ellipse representing the horizontal principal meridian, *h h'*, at right angles to the principal vertical meridian to which they are parallel, as shown in *H*, Fig. 2.

Now, the position of the focus of any one of these ellipses in relation to the focus of the principal meridian depends upon two things: first, upon the radius of its curvature as compared to that of the principal meridian; and secondly, upon the position of its principal point (from which its focal distance is measured) as compared with that of the principal meridian. These relations, again, depend upon the relations which exist between the three axes of the ellipsoid. Thus, the curve of the horizontal meridian *h h'* in *H*, Fig. 2, formed by the principal points, *a*, *c*, *e*, *o*, etc., of the vertical ellipses, will depend upon the relation of the antero-posterior axis to the horizontal axis, whereas the curvature of the ellipses themselves, on which their foci depend, will be governed by the relation between the antero-posterior and the vertical axis.

Let us take, as an example to illustrate our meaning, the case where rays fall on the sharper end of the ellipsoid, or in the direction of the major axis, and let us assume that the vertical meridian is the more strongly curved, and that the ellipsoid is divided into a series of ellipses parallel to the vertical meridian. It is apparent that these ellipses become constantly smaller, with shorter radii of curvature, as they pass toward the periphery from the principal meridian, for they finally disappear as a point at the apex *h'* of the ellipse on the blunter end of the ellipsoid. The effect of this would, of course, be a constant shortening of the foci. But

at the same time there is a constant recession of the principal points, *c*, *e*, *o*, from the principal plane of the principal vertical meridian passing through *a*, with, of course, a concomitant recession of the foci.

Now, if we can have such a nice adjustment of the three axes that these two conditions shall neutralize each other, the line formed by the focal points of the series of ellipses will be a right line, falling in a vertical plane passing through the principal focus of the principal vertical meridian. There is, therefore, *one* possible form of ellipsoid, and only one, in which the focal line of one of its meridians will be a straight line and lie in the plane passing through the focus of the vertical meridian. Whenever there is any deviation from this form of ellipsoid, the focal line will no longer be straight, but curved, and the direction of its curvature will depend on the predominating influence of the one or the other of the above-named factors. If the relation between the major and the horizontal axis is such as to cause the setting back of the principal points to be the more powerful, then the curve would be backward, as shown in *x'*, Fig. 2; should the relation of the axes be such that the shortening of the foci would be in excess, then the curve would be in the opposite direction, or forward, as shown in *x*. It follows, also, from what has been demonstrated, that in no triaxial ellipsoid can such a relation between the axes exist as to cause *both* the focal lines to be straight; for, as we have seen, there is only one relation of the ellipses that can bring about such a result, and as from the very nature of the figure the ellipses in the two meridians must be different, if one has this form the other cannot have it.

I was in hopes to be able to present some general formula which would apply to all forms of ellipsoids, but my mathematical friends to whom I broached the subject have assured me that such a thing is impossible. It will be necessary to treat every form of ellipsoid (of which there is an almost infinite number) separately, and as the task is a tedious and by no means an enviable one, it would hardly be worth while to undertake it unless for some special case.

LARGE TUBERCULAR TUMOR OF THE CHOROID. ENUCLEATION OF THE EYE; RECURRENCE OF ULCERATION IN THE CONJUNCTIVA AND LID; DEATH FROM TUBERCULOSIS OF THE LUNGS.

By SWAN M. BURNETT, M.D., Washington.

OPHTHALMIC AND AURAL SURGEON TO THE CENTRAL DISPENSARY.

IN 1858 Manz published a case which for the first time established beyond peradventure the occurrence of tubercle in the human eye. Since then ophthalmological literature has contained occcasional reports of cases of what was supposed to be tubercle found in various parts of the organ. Quite recently the subject has been studied from the standpoint of general pathology, and a large number of experiments have been made for the purpose of demonstrating the inoculability on the part of the eye of tuberculous material. The question still at issue is more as to the microscopical character of tubercle, and as to whether it has any distinct histological aspects. Under these circumstances, it seems to me that it would now be in order to study these supposed tubercular tumors in connection with their clinical history and the general course of tuberculous disease as we find it manifested in other organs of the body.

It is for the purpose of adding my mite to this study that I communicate the notes of the following case.

Annie Neal, a mulatto girl, tall, but of rather frail appearance, just turned into her thirteenth year, applied for relief of a trouble in the right eye at my service at the Central Dispensary, on the 7th of April, 1882. The only history I was enabled to elicit at that time was, that six weeks ago she had a very severe pain in the face, accompanied by a redness of the right eye. The pain had

quite subsided, but the inflammatory appearances had persisted, and steadily got worse. At that time there was a circumscribed swelling, of the same diameter as the cornea, on the outer side of the ball. Its anterior border was removed about six *mm.* from the base of the cornea ; there was some ulceration at the apex. The pupil was dilated *ad maximum*, and there was a uniformly grayish reflex from the interior of the eye. Cornea and lens clear. The conjunctiva was chemotic. No perception of light. Not having any doubt as to the presence of some form of intra-ocular growth, I at once took her into the house, and removed the eye, carefully taking away all of the conjunctiva which seemed to be implicated.

The healing was prompt and rapid, and in the course of a week the conjunctiva was smooth and secreting only a small quantity of muco-pus. On the 5th of May, when she presented herself after an absence of some weeks, there was found a large glandular swelling in front of the right ear, and under the angle of the jaw. It was hard and nodular, but painless. In course of time it became soft, and on the 11th of August I opened it and let out a quantity of thick pus. It continued to discharge more or less for two months, when it healed, but the cervical glands on that side continued enlarged and indurated until death. At the end of about two months, some slight changes were observed in the condition of the conjunctiva of the orbit. It lost its smooth appearance, and looked more granular than before ; still there were no clearly defined nodules, nor any points of ulceration. When she reported on the 6th of October, however, an ulcer was found along the inner margin of the upper lid. It was about one *cm.* in length and six *mm.* in breadth, extending back into the conjunctiva of the lid ; its bottom was granular.

The granular appearance of the conjunctiva had increased, and there was an apparent loss of its substance at the apex of the orbit. On the 27th of October there was an evident increase in the size of the ulcer, and it extended backward for some distance into the conjunctiva of the lid, which at that part was elevated into a circumscribed swelling, into which the ulceration extended. The loss of substance at the apex had also become greater, reaching forward as narrow, deep furrows. These conditions of the conjunctiva remained unchanged until death. There was no perceptible increase in the extent of the ulceration, nor was there any tendency manifested to heal.

At the time of the enucleation of the eye there were no general

symptoms which could direct the attention to tubercular affection in any organ. The general health of the girl appeared to be good, and the history of the eye-trouble suggested either a glioma of the retina or a sarcoma of the choroid. The enucleated globe was placed in Müller's fluid for examination at a future time. On the appearance of the swelling of the pre-auricular glands, however, I began to suspect a scrofulous or tuberculous affection, which might turn out at least a complication, even if the ocular tumor was not found to be tubercular in character. I therefore made an examination of the lungs, and found, I thought, marked dulness on percussion under the left clavicle, jerky respiration and bronchial breathing. There was no cough, and the nutrition seemed to be good. The patient was examined by several gentlemen at the Medical Society of the District of Columbia, before which she was exhibited, and opinions were divided as to the diagnosis of tubercle of the lungs based on the physical signs. The further clinical history of the case is unfortunately brief. She soon began to decline in strength, to lose flesh, a cough set in, and there was increase of temperature. All these symptoms gradually increased in intensity, and she died on the 2d of March, 1883, under the same conditions as all those who die of rapid consumption. An attempt was made to obtain a post-mortem examination, but unfortunately it failed.

An inquiry into the family history revealed the fact that she was the eighth child of the family who had died with affections (probably tubercular) of the lungs or bowels, she living the longest of any. Her father died of consumption, as did also several members of his family.

EXAMINATION OF THE TUMOR.

A section of the eyeball showed a total detachment of the retina; at no points was it in contact with the other structures, except at the optic-nerve entrance and ora serrata. From the choroid there sprang a growth which extended from around the optic-nerve entrance forward, reaching on the outer side to near the ora serrata. Its anterior limit on the inner side was somewhat short of this, and was still shorter superiorly and inferiorly. The mass seemed to surround the optic-nerve entrance rather than to spring from the nerve itself. On the outer side a large nodule arose

abruptly to the height of about ¾ of a *cm.* from the level of the sclera. It then descended somewhat abruptly again to a thickness of ½ *cm.*, and, spreading out, continued so to within a short distance of the ora serrata, where it thinned rapidly and merged into the surrounding tissue. There was another nodule, smaller, on the inner side of the nerve, and several others still smaller, which seemed to be only a circumscribed elevation of the general thickening. On section, these nodules and the thickening were yellowish, but not homogeneous in structure, having streaks of harder material in softer. One of the nodules, which corresponded to the external tumor, when cut into, was found filled with a broken-down fluid material. The largest nodule near the optic nerve was firmer in consistency. The interior of the general thickening was granular when the hardened specimen was cut into, and the two walls were easily separated.

The general relation of the parts is shown in the accompanying diagram.

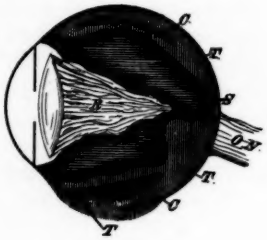

FIG. I.

O N, optic nerve; *R*, detached retina; *S*, sclerotic; *T T T*, tumor; *C C*, cavities in tumor.

Histologically, the growth consists of a groundwork of small round cells with nuclei, and a small quantity of connective-tissue substance, which would be at once recognized as granulation tissue. These cells were well stained by hæmatoxylin. Scattered through this, at irregular intervals, was another substance, which corresponds to the appearances of the so-called giant-cell. These giant-cells varied greatly in size and in contents. As a rule they were well filled with nuclei, which took usually a much lighter

staining than the cells of the stroma. Aside from these nuclei, they contained a substance which took no staining, but remained of a yellowish tinge. In some it was quite hyaline in appearance, *d*, *e*, but in others it was evidently degenerated cellular tissue, *a*, *b*, *c*. Besides these clearly-defined

FIG. 2.

a, *b*, *c*, Giant-cell filled with granular material; *e*, *d*, giant-cells with hyaline contents; *g*, giant-cell filled with nuclei; *i*, irregular space filled with granular matter.

cells, mostly oval in shape, there were other areas, often of great extent and of irregular outline, which were filled with this unstained granular material *i*. There was no pigment in the substance of the growth anywhere except in the immediate vicinity of the choroid, which was almost completely disorganized, though the hexagonal cells were often found intact as a layer for some distance on the surface of the tumor seeming to show that the growth had been more toward the sclera than toward the retina; and macroscopically, the pigment layer was to be seen covering the growth at all parts except over the very large nodule near the optic nerve. A section through this discovered a streak of pigment through its centre, corresponding in direction to that of the choroid. Sections of the optic nerve showed it to be unaffected. The cavities in the growth contained round nucleated cells, with a trace of connective tissue and a quantity of broken-down, unstained substance, most probably degenerated cells. Everywhere there was a manifest

tendency to invade the sclerotic, particularly in the vicinity of the vasa vorticosa; and for some distance away from the tumor-substance the nuclei around these vessels in the sclera were largely increased in number. No attempt was made to discover the turbercular bacillus.

REMARKS.

In regard to the histological structure of tubercle, opinion seems not to be definitely settled. In fact, it can hardly be said that at this time we have any one characteristic microscopical appearance which marks a growth as tubercular, though the time has been when authorities were very positive on this question. Laennec regarded the caseous matter as pathognomonic; Lebert looked upon the shrunken cell as essential; and Virchow considered a tuberculous character indicated when there was the elementary grayish tubercle, a conglomeration of round lymphatic cells with a tendency to necrobiosis.

Some recent investigators, among whom are Wagner, Schüppel and Friedländer, have insisted on the giant-cell as peculiar to the tuberculous growth.

The histological type of tubercle they consider to be one or more giant-cells surrounded with larger many-nucleated cells and smaller lymphoid cells embedded in a net-work of cells with variously formed processes—endothelioid—and with an infiltration for some distance of small round cells.

It is now, however, universally admitted that these giant-cells are found in other pathological products, such as lupus, syphilis, and even granulation tissue.[1]

So firmly is this want of confidence in an essential histological character impressed upon Cohnheim, that he insists on inoculation of animals as the only absolute proof of the tuberculous nature of a morbid product. If it produce tubercle the character of the growth is at once settled.

In this unsettled state of opinion clinical observation becomes of great value. If, in connection with a morbid growth, about the nature of which we are in doubt, we find

[1] See Baumgärtner, Græfe's Archiv, B. xxv, 3, p. 187.

clinical evidences of tubercular invasion of other portions of the body, we can then rationally infer that nature has performed the experiment of inoculation for us, and furnished us with the desired proof. It is in this connection that we consider the preceding case of interest. The general aspect of the patient, the early appearance of the dulness and bronchial breathing over the upper portion of the left lung, the glandular swelling before the right ear and under the angle of the jaw, the enlargement of the cervical glands, the ulceration of the conjunctiva appearing some time after the enucleation of the affected ball, and the whole course of the disease to her death, as well as the family history, all point to a tubercular cachexia.

I think, too, that there are some valuable diagnostic points in the microscopical appearance of the tumor itself. Tumors the size of this one in the interior of the eye are either gliomatous or sarcomatous, though certain forms of metastatic choroiditis sometimes offer analogous aspects.

In the last case there would be an antecedent history of an affection likely to lead to a metastatic process. In the case of either glioma or sarcoma, the tumor is more circumscribed and evidently takes its origin from one spot, while in tubercular tumors, besides the diffuse thickening of the choroid there is evidently more than one point from which the growth proceeds, and in the interior of the tumors as well as of the diffuse thickening there are areas of soft or even liquid degeneration, which we do not find in either the glioma or sarcoma. And I think that some suggestion of a tubercular growth would come from the ophthalmoscopical appearance. In glioma and sarcoma, both of which are more or less vascular, we have usually a red or yellow reflex from the pupil (amaurotic cat's eye), though where the sarcoma is very heavily pigmented this may be very slightly marked. In the tubercular tumor, which is only slightly if at all vascular, we should expect not a red or yellow but only a grayish reflex, as was the case in our patient.

Such large tubercular tumors of the choroid as we have described seem to be rare. Miliary tuberculosis of the choroid is rather common, and their discovery by means of

the ophthalmoscope is often the first indication of a general development of miliary tubercles manifest in other parts of the body; but of such large confluent growths only a few are on record. The first one of which an accurate account is given is by Von Gräfe in the second volume of his *Archiv*, p. 210. It was in the eye of a pig, but its histological character, in the light of more modern investigation, leaves but little doubt of its being tuberculous. Another case is reported by Manfredi in the *Archives d' ophthalmologie*, tome 1, No. 1, p. 44; one by Poncet in *Gazette Médicale*, 1875, Nos. 7 and 8; one by Haab in *Gräfe's Archiv*, xxv, 4, p. 163; one by Gowers (examination by Nettleship) in his "Medical Ophthalmoscopy," 2d ed., p. 223; and one by Hirschberg in the *Transactions of Seventh Session of the International Medical Congress*, 1881 (ophthalmological part, p. 119).

It is pretty certain, however, that some of the intra-ocular tumors reported by some of the older writers were, from the histories of the cases, tubercular.

Since this paper was prepared for the press, I see in Hirschberg's *Centralblatt* for June, 1883, a notice of a case of chronic tuberculosis of the choroid reported by Dr. Hosch, and published in the *Correspondenzbl. f. Schweiz. Aertze*, March, 1883. It was a large confluent tumor springing from the posterior part of the choroid. Rabbits, which were inoculated in the anterior chamber with the broken-down material, developed gray tumors on the iris at the end of from 22 to 39 days. It is not stated whether the patient was affected with general tuberculosis.

One interesting point in our case, which I have not seen mentioned by others, is the ulceration on the lid and conjunctiva returning after a perfect healing of the enucleation wound. This would seem to point to a local inoculation, and should cause us to exercise the same care in a thorough cleansing of the orbit in the cases of supposed confluent tubercle as in glioma and sarcoma.

WOUND OF AN EYE BY A MISSILE FROM A CROSS-GUN; ENUCLEATION FOR SYMPATHETIC IRRITATION; REMARKABLE LESION IN THE IRIS; CYST-LIKE COLLECTION OF FLUID.

By DAVID WEBSTER, M.D., New York.

(*With one Wood-cut.*)

Mrs. G. brought her son, twelve years of age, to Dr. C. R. Agnew for advice on April 30, 1883. She gave the following history: On the 6th of October, 1880, he and a schoolmate were shooting from a cross-gun together. Having broken their arrows they pulled ditch weeds,—"golden rod,"—which were dry, and used them instead. The boy's playmate accidentally shot him in the eye with one of these missiles. The stick entered the cornea of the left eye. The sight was, as she believes, destroyed at once by the injury. His nervous system was so shocked that it was some weeks before he was able to be taken to New York for treatment. About the middle of November, 1880, he was taken to the New York Eye and Ear Infirmary, where he was placed under ether, and an exploratory operation performed, as the mother understood, but none of the stick was found in the eye. Her family physician, who was present at the operation, informed her that the original wound was reopened, and the eye explored through it; also that "they thought the blow had caused a separation of the retina, and a dislocation of the lens." The inflammatory reaction and pain following the operation passed off in about a month. For about two years thereafter, the blind eye was not troublesome, and was "perfect" in its external appearance. In October, 1882, his mother observed, while washing him, a small white spot in his pupil, and on watching this spot, she found that it gradually increased until it filled the whole pupil. No further change occurred until March, 1883, when the eye became red and painful without apparent cause, and the right eye began to sympathize, being painful on use, and sensitive to light.

Although the blind eye is now free from redness, the right eye

still suffers from sympathetic irritation. There is no special tenderness on pressure of either eye. The lens of the injured eye is opaque. The iris is adherent to the lens capsule at its pupillary border, and so arched forward as to make the anterior chamber very shallow, except over the pupil. Tension slightly increased. No perception of light. Right, Vision, $\frac{20}{20}$; Hm., $\frac{1}{24}$.

On May 3d, Dr. Agnew enucleated the eyeball, and, after soaking in Müller's fluid a sufficient length of time, it was examined by Dr. T. Mitchell Prudden, who kindly gave us the following report:

"*June* 19, '83.—The cornea is normal except at the periphery, where, in the vicinity of the blood-vessels, there is a slight infiltration with small spheroidal cells. The anterior chamber, which is very shallow by reason of the arching forward of the iris, contains a small quantity of homogeneous fluid. The iris is dense, its blood-vessels compressed, and pigmented cells are unevenly distributed through its substance. The uveal layer on either side of the pupil is separated from the rest of the iris by a *cyst-like collection of fluid* (1), which

extends from the border of the pupil back nearly to the ciliary body. The pupil is crossed by a thin, veil-like, organized membrane, consisting of stellate, fusiform, and spheroidal cells, with a very small amount of finely fibrillated intercellular substance. The separated uveal layer of the iris is closely attached, posteriorly, to the middle third of the lens, but in the peripheral segment is separated from it by fluid (2).

"Just within the anterior-lens capsule lies a thin membrane of connective tissue (3). The lens substance is more or less disintegrated throughout, being in many parts broken into irregular fibrils, in others thickly studded with spheroidal

cavities, and in others presenting large irregular cavities filled with globular and irregular-shaped masses of disintegrated lens substance.

"The fibres of the suspensory ligament and zonula are stretched and separated by fluid which contains pigmented and variously shaped cells.

"A narrow, dense, cyclitic membrane (4) passes across the eye close behind the lens.

"The ciliary body is flattened and its pigmented layer irregular by reason of the peeling off of the cells.

"The retina is completely detached, is œdematous in places, and has undergone, throughout, the proliferative and degenerative changes common in incipient atrophy of the bulb. The choroid is much flattened and partially atrophied."

It is believed that the separation of the uveal layer from the rest of the iris by a cyst-like collection of fluid, as shown in the drawing, is a rare lesion. Dr. Prudden considered it rare and interesting. I have looked through Dr. A. Alt's work and do not find it mentioned there. I have also ventured to interrogate Dr. Knapp, who replies that he thinks the lesion is quite rare.

In reference to the history of the case it may be proper to add that all symptoms of sympathetic irritation passed rapidly away after enucleation of the offending eye, and that the child wears an artificial eye with satisfaction.

A CASE OF RIGHT-SIDED HEMIANOPIA AND NEURO-RETINITIS, CAUSED BY A GLIOSARCOMA IN THE LEFT OCCIPITAL LOBE.

By Dr. LUDWIG FANY, of Breslau, Prussia.

(*With two Wood-cuts.*)

Translated by Dr. Charles Zimmermann, of New York.

Mary Giehmann, of Altwasser, Germany, aged twenty-one years, the daughter of a sailor, was treated at my dispensary service since 6th of May, 1881, for impairment of sight, existing from the beginning of January, 1881. She was a tall, slender girl of anæmic appearance, giving the following history: Her parents, both living, are healthy. She has two older brothers, and a sister younger than herself (two having died when young), who are of good constitution and enjoy excellent health. When a child, she went through all diseases common to that age without any trouble. At the age of five years she was melancholic for a few days, in consequence of her father's absence for a fortnight. Her mental depression disappeared soon after his return. From her twelfth year she speaks somewhat through the nose. At the beginning this trouble was so pronounced that a tumor was suspected to develop in the nose. Her menses began at her fifteenth year. Two years ago she gave birth to a child, still living and quite healthy. The father of this child died about a year ago of a lung disease. After her delivery, she suffered for two months from serious rheumatic fever. Her present disease began suddenly with headache and vomiting here at Breslau, where she was a servant, in the last days of December. Therefore, at the beginning of January she left this place, and went to her parents at Altwasser, where she was treated by two physicians. A marked drowsiness, fretfulness, and vertigo, associated with headache, which was prevailing in the left occipital region. The vertigo was sometimes of such a degree that, when accidentally going through the room, she had to take hold of a chair or table to prevent herself

from falling down. At the very beginning of the disease, as soon as headache set in, she felt a peculiar paræsthesia in the right side of her face; she experienced something like hot water running through her face. Then anæsthesia of the right side of her face appeared. She did not feel the pins with which her physician pricked her. Electricity was applied for some time. During January and February her speech was affected. She was able only to stammer, and sometimes could not utter a syllable. She says that finally both eyes came out from the orbits during the fits of headache and vomiting. Of late she observed this symptom only in the left eye. Besides that, she has now a sensation of heat and formication in the skin of the left side of her face, when headache comes on.[1]

Status præsens.—Patient is moderately well nourished. Speaks through the nose, the latter being a little swollen at its root, but not tender upon pressure. The eyes look normal. No exophthalmus. L. E.: Barely counts fingers at about 8″, only by excentric fixation. Field of vision very much contracted in its upper, lower, and outer portions. Absent altogether in its nasal half.

The examination with the perimeter was not possible. R. E.: M. $\frac{1}{60}$ S. = $\frac{6}{36}$. Temporal half of field of vision absent; very much impaired upward, inward, and downward. (Perimeter upward, 25°; inward, 22°; downward, 18°.) The line of demarcation does not run through the point of fixation, but deviates somewhat in an outward direction in the upper half, at a distance of about 7° from the centre. O. L. E.: The whole disc is a dirty white; pretty much swollen, especially in its central portion; its lens being hazy and indistinct; its outlines indistinct and steep, so that the ascending and descending vessels are somewhat bent at the edge. Disc has a more oval shape in the vertical direction. Retinal veins of normal size; arteries attenuated; no change in the remaining background. R. eye: Papilla also very much swollen, but not quite so white as the left; rather whitish-gray and nearly round. Retinal arteries and veins are thicker than in the left eye; no circumscribed anomaly visible in the whole background. It is to be mentioned that percussion of the head at the frontal, temporal, and occipital regions produces no pain, which in most cases is indicated by dis-

[1] Somewhat later, I learned, through the kindness of Dr. Adam, of Altwasser, who treated her from the 12th of January to the end of April, that the left eye showed choked disc, with a small degree of exophthalmus and a staring look, as early as the end of January. Disorder of intellect was noticed neither by him nor by her relations.

tortion of the face. No trace of infection could be revealed by the most careful examination. The movements of both eyes, and the general sensibility and strength of the extremities, were normal. On tactile and thermic irritations, a certain dulness of sensation at some spots of the right side of the face was discovered. No mental disturbances could be noticed.

The first question, What brought about all the symptoms in this case? was evidently not difficult to be answered. No practitioner who is somewhat familiar with cerebral diseases will hesitate to make the diagnosis of cerebral tumor from the symptoms above mentioned: headache, vomiting, vertigo, mental depression, drowsiness, paræsthesia and anæsthesia, transitory disturbances of speech, associated with choked disc, neuro-retinitis, and finally hemianopia.

There was a second question more difficult to be answered: Where was the tumor located?

In regard to this, the hemianopia had to be considered as a guide. We know that headache, vomiting, choked disc, and neuro-retinitis are symptoms only of an intracranial increase of tension, and are of no particular value for the localization of a tumor cerebri. Three possibilities had to be taken into consideration on the basis of the semidecussation of the nerve-fibres in the chiasm, the existence of which is now fully established. (I refer to the newest excellent treatise upon that subject by Mauthner.[1]) The tumor might be located at the basis cranii, or in the thalamus, or at the origin of the optic nerve, *i. e.*, in the occipital lobe. There was no symptom advocating the situation of the tumor at the base, *i. e.*, in the middle cranial cavity, no cerebral nerve situated near the optic tract being disturbed in its conductive power. Furthermore, it is not probable that a basal tumor could compress completely or destroy the left side of the chiasm, or the left optic tract, without irritating or paralyzing simultaneously one of the other cerebral nerves on that side.

Nothing supports the second possibility, that the interruption of conduction in the optic fibres was caused by a tumor

[1] "Gehirn und Auge," von Dr. Ludwig Mauthner. Vorträge aus dem Gesammtgebiet der Augenheilkunde, 6–8 Heft, Wiesbaden, 1881.

occupying the optic thalamus, unless the occasional vaso-motor symptoms (sudden flush and heat of the face, exophthalmus) are considered of great importance as to the presence of a tumor in the optic thalamus (according to Petrina).

The third possibility seemed to be the only plausible supposition, viz.: the existence of a tumor at the origin of the optic nerve. This was supported further by the absence of motor paralysis, and the pain which the patient felt in the occiput.

This latter fact is regarded by Pitres and Nothnagel as conclusive evidence. I derived great aid in the diagnosis from the incident literature, viz.: in the first place, the anatomo-pathological conditions of defects in the cortex of the occipital lobe, in cases of atrophy of the optic nerve, described by Huguenin; in the second place, the results of the post-mortem examinations in those three well-known cases of Curschmann, Westphal, and Jartrowitz. My opinion was, however, most strongly supported by the famous physiological discoveries of Munk,[1] who succeeded in producing contra-lateral hemianopia by experimental destruction of the occipital cortex. I left undecided the last question which could have been asked, viz.: whether the tumor occupied only the cortex, or extended also more or less to the subjacent layers of white substance.

I directed the patient to be careful, and in want of something better, I gave her the favorite iodide of potassium in small doses, and asked her to call again after some weeks.

May 31st.—Patient returned. Her condition is about the same. During the last days severe headache, accompanied by vomiting. I ordered a seton to be applied to her neck.

June 1st.—Free from headache, from which she suffered yesterday.

June 4th.—General health much better; no headache at all during the last days. Her sight has improved (S. = $\frac{6}{15}$).

June 8th.—Felt comfortable from 4th to 7th of June. At this day, in the afternoon, headache with chills set in again. Last

[1] "Ueber die Function der Grosthirnrinde." Gesammelte Mittheilungen aus den Jahren 1877–1880, von Prof. Hermann Munk, Berlin, 1881.

night pretty good. To-day, at about nine o'clock A.M., headache, now prevailing in the left frontal region, was more intense, and vomiting occurred at intervals three times. The patient feels weak and exhausted, looks apathetic, and complains again of formication in the left side of her face. She has the sensation as if both eyes were coming out of the orbits. There is apparently a small degree of exophthalmus of the left eye, which is sensitive upon direct pressure. S. only $\frac{6}{60}$. On examination with the ophthalmoscope a change is noticed, in so far as now the right optic disc is also beginning to become white, and does not appear round, but pushed inward at its outer-lower margin (inv. image).

June 10th.—Yesterday and to-day, during the whole forenoon, headache and nausea; no vomiting. The pain is exclusively felt in the left occipital region; and the left half of her face and the left ear have been several times red and hot again.

June 11th.—At ten o'clock A.M. severe convulsions and loss of consciousness began, preceded early this morning by excruciating headache and constant vomiting. At two o'clock P.M. death occurred.

A post-mortem examination was not consented to at first, but after forty-six hours I received the permission to open the cranial cavity. The following report I owe to the kindness of Prof. Dr. Marchand, at that time first assistant at our pathological institution.

Cranium thin; a moderate quantity of blood in the longitudinal sinus. Dura mater unchanged; it adheres to the left occipital lobe only in one place, which represents an almost hemispherical prominence above the level of the neighborhood, about 3 *cm.* in diameter (*a*, figs. 1 and 2). At the corresponding part of the skull, immediately above and to the left side of the eminentia arcuata, there is a smooth depression exactly corresponding to that prominence, and of the same diameter. It penetrates the whole substance of the bone, so that a triangular defect is noticeable, 1 *cm.* in height and 1 *cm.* in width, only covered by a thin membrane. The whole region of the bone is convex at the outer surface. The lambdoid suture passes through the middle of this prominence. It has an ossiculum Wormianum right at the place of the defect, so that this defect is partly bordered by the suture. The surface of both cerebral hemispheres is considerably

flattened, the furrows not marked, the larger veins moderately filled, and the small ramifications uniformly congested, especially those of the right hemisphere. The posterior portion of the

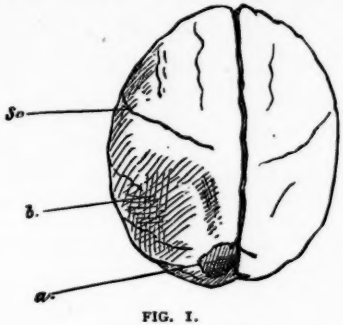

FIG. 1.

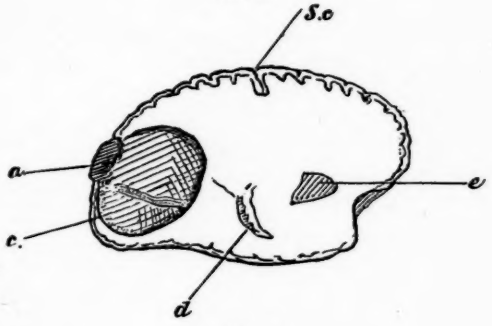

FIG. 2.

left hemisphere shows, besides the prominence mentioned above, a considerable depression (*b*, fig. 1), which occupies the posterior portion of the parietal lobe and the whole occipital lobe. This depression was brought about by evacuating several tablespoonfuls of a clear yellowish fluid when the brain was taken out. The depressed portion, not sharply defined, extends forward to the vicinity of the posterior central gyrus. The whole segment of the hemisphere behind it gives the feel as of a loose bag, and is somewhat denser at the smooth medial surface. The depression can be noticed also at the lower surface of the occipital and temporal lobes. The anterior half of the latter is of the same shape and consistence as on the right side. The above-mentioned prominence of the left occipital lobe is mostly of a reddish-

yellow color, of soft consistence, with a smooth surface. It belongs only to the convexity, occupying exactly the apex of the occipital lobe. Small vessels run over it; some larger ones pass along the margin, identical to those of the pia mater. The tumor extends forward close to the parieto-occipital sulcus and its continuation at the convexity. The posterior margin of the parietal lobe can easily be raised from it. Medially, the tumor is firmly connected with the pia mater, shows a pale gray color, somewhat transparent, and seems partially to adhere to the cerebral substance. The adhesion of the dura mater, just mentioned, is confined to a district of 2 *cm.* in diameter. The dura itself is not changed there.

A sagittal section of the hemisphere, through the middle of the tumor (fig. 2), shows immediately below the latter a very large cavity surrounded by a completely smooth and transparent membrane of a pale-yellowish color, in which a number of small vessels run. The cyst has a diameter of 8 *cm.* in length and 8 *cm.* in width. It extends from the apex of the occipital lobe near the descending cornu, at a distance of about 4–5 *cm.* from the central gyrus. From the lower wall of the cyst starts a membranous cord, about 8 *cm.* long and 1½ *cm.* broad, in general of the same character as the remaining wall, apparently attached to the region of the external tumor, and passing through the cyst like a bridge. A connection with the ventricle or the plexus cannot be observed, and, besides the cyst, no remainder of the posterior horn can be found. The delicate wall of the cyst can be very easily separated from the soft cerebral substance, which shows no fatty degeneration or yellow softening. The brain-substance between the wall of the cyst and the base of the occipital and temporal lobes is only 1 *cm.* thick; at the external circumference of the convexity it is reduced to a few millimetres. The size of the cyst, when filled, may have been that of an orange.

At the external prominence the wall is occupied by a tumor, which is about 2 *cm.* thick, soft, pale, of a reddish and somewhat transparent gray. It contains many yellow patches, and is softened in its interior. About in the centre of this tumor there is a large dark-red and soft node about the size of a hazel-nut, dissolving into a large quantity of vascular villi connected with each other by a loose neoplastic substance. The remainder of the tumor is also very vascular. The border of the neoplasm passes into the cerebral substance without a distinct boundary.

The whole brain is very soft, contains a moderate quantity of blood, and is macerated partially in the neighborhood of the ventricle. The ventricles are not enlarged. Circumscribed changes are nowhere visible except those mentioned before. We state expressly that the great ganglia: thalamus opticus, corpus striatum, nucleus lenticularis, chiasma, optic tracts, are without any alteration.

On examination with the microscope the soft neoplastic tissue is formed by round and oval cells embedded in a scant, finely granulated substance. At places the round, at others the oval, elements are prevailing. Between the smaller cells there are larger and multi-nucleated cells strewn about. Frequently the oval elements are very large; have long, more or less slender or ribbon-shaped, processes, looking like axis-cylinders, the cells themselves having the form of ganglia. The oval cells are closely connected with the vessels, which are surrounded by a dense layer of spindle-shaped cells. This becomes clear after their isolation by teazing and similar manipulations. The vessels show frequently varicose enlargements well filled with blood. They are most marked at the dark-red convolution mentioned above. The inner wall of the cyst has no epithelium. The soft, gelatinous cyst-wall, from 1 to 2 *mm.* thick, consists of similar, but mostly shorter and thinner, with spindle-shaped nucleated, enlargements. The tumor is therefore a soft *gliosarcoma.* It is most probable that it started from the interior of the occipital lobe, in the vicinity of the posterior cornu, perhaps from the ependyma, and grew gradually to the surface. The broad, longitudinally folded band which passed through the cyst was denser than the inner lining of the cavity. It was fibrillated like thickened ependyma, representing perhaps a remainder of the ependyma of the posterior cornu. It cannot be ascertained whether the cyst was originally connected with the cavity of the occipital horn, or was produced only by softening of the substance of the tumor. But the former supposition is more probable on account of the clear watery character of the fluid. Nearly the whole medullary substance of the occipital lobe and the posterior portion of the medullary layer of the parietal lobe were destroyed by the cyst. The external flattening, of course, does not correspond to the real extension of the cyst, the anterior wall remaining from 1 to 2 *cm.* distant from the descending cornu of the lateral ventricle. The gray cortex is replaced by tumor-substance only as far as mentioned above.

In conclusion, I have to remark that this case is similar to the three cases of Curschmann, Westphal, and Jastrowitz, before alluded to, concerning their importance as to the explanation of hemianopia. Our case is interesting for the reason that the cerebral tumor, having existed probably for years, remained perfectly latent for so long a time; further, that besides the hemianopia no additional symptoms of a circumscribed disease in the brain developed until the fatal issue, similar to Curschmann's case. Our case may therefore be considered as furnishing conclusive evidence for the location of the visual centre in the occipital lobe also in man.

In the literature at my disposal about tumors of the brain, I find only one similar observation, and this is in Virchow's "Oncology," vol. ii, p. 144. It refers to a man suffering from convulsions, mostly in the left extremities, now and then extending to the right side, for seven years, who finally showed symptoms of lunacy. The post-mortem examination revealed a glioma of the right occipital lobe the size of a large apple. A cavity in its interior, with rough, uneven walls, was filled with about four ounces of a dark fluid. Unfortunately, nothing was noted about the condition of the eyes during life, but it may be assumed, from the analogy with our case, that hemianopia existed, but was overlooked.

To avoid any misconception, I will state that by the heading of this paper, "Hemianopia and Neuro-retinitis," I did not intend to decide upon the priority of either symptom. I have described the succession of the two symptoms in such a manner as they revealed themselves by the clinical history and the examination. According to this, the neuro-retinitis would have been previous to the hemianopia; but it is quite possible that the hemianopia preceded the neuro-retinitis.

THE EYE-DISTURBANCES IN TABES DORSALIS.

By LUDWIG SCHMEICHLER,
PHYSICIAN TO THE GENERAL HOSPITAL OF VIENNA.

(*See figs.* 1–5, *plate ix.*)

Translated by Dr. N. E. Brill, New York.

THE various disturbances which affect the eye in locomotor ataxia have, in the last few years, been made the subject of many treatises, both by ophthalmologists and neurologists. If it is undertaken to treat of this subject once more in the present paper, it is because, as the question of the curability of tabes has come again into prominence, the eye-symptoms of this disorder claim renewed attention, inasmuch as the disturbances of the visual apparatus are almost always initial symptoms,—and of these the most marked objectively.

In this communication it will be attempted to give a survey of what is known, and to add and apply new observations and reasonings. The clinical material was obtained during a long period of study in the eye-clinic of Prof. Arlt, in the fourth medical division of the hospital, whose inmates are in part sufferers from nervous disorders, and in the Home for Incurables. In the eye-clinic, tabes was studied in its beginning; in the medical division mentioned, in its progress; and in the Home, in its last stages.

The changes in the eye comprise those of of the optic nerve, of the pupil, and of the eye muscles.

I. Disease of the Optic Nerve.—Atrophy of the optic nerve is a frequent and early symptom of tabes; this is, however, not recognized by all ophthalmologists and

neurologists. In the latter case it is because they see tabetic patients with commencing optic-nerve atrophy more rarely, the patient being sent to them only after other positive nervous disturbances have appeared. Should the patient, however, consult an ophthalmologist on account of his optic-nerve disorder, he will, when asked whether he has any other complaint to make aside from his visual impairment, usually give a decided negative answer. The ophthalmologist who contents himself with this answer will then conclude that "the importance of optic-nerve atrophy as an early criterion of tabes has been exaggerated" Förster (1).

If the tendon reflexes, however, are tested, the knee-phenomenon will be found absent; the patient is now pressed to tell whether he ever has had rheumatic pains, and he will then give—although, perhaps, only after prolonged questioning—a definite description of the lancinating pains, which the majority of them commonly attribute to changes in the weather. Beginning atrophy with fully developed and advanced posterior spinal sclerosis (that is, with completely developed ataxia) was not observed; there are, however, cases where the first lancinating pains appeared years after the development of the optic-nerve atrophy.

Erb (23) calculates that 12 per cent., and Möli (17) that 13.5 per cent., of all cases of tabes have optic-nerve atrophy. I have carefully examined for tabes all patients who came to the eye-clinic with beginning optic-nerve atrophy, and, aggregated with the cases observed elsewhere,[1] yielded a percentage of 40.

Before I proceed to a consideration of the functional disturbances, I may be permitted to relate a few histories of patients to which I shall have to refer later on.

CASE 1.[2]—Ignatz P., merchant, asserts that previous to an amblyopia, which appeared five months before, he was healthy; it

[1] In the Home for Incurables and the fourth medical division of the general hospital.

[2] Y., years; V., visual power; Jg., Jaeger's test-types; mot., motility; L. E., left eye; R. E., right eye.

soon was discovered that the patient had lancinating pains for five years and suffered occasionally with headaches. Medium build; pupils 3½ *mm.* in diameter, reflectively immovable; levator palpebræ of both sides paretic; other eye-muscles normal; optic-nerve atrophy of both eyes; vessels normal in calibre; L. E., fingers directly at eye; R. E., fingers at 20 *cm.*, recognizes no color but blue; mot. and sensibility normal; knee-phenomenon absent; little ataxia.

Case 2.—Marie M., thirty-seven years old, dress-maker, married for fifteen years; three healthy children; no miscarriages. Has had lancinating pains and paræsthesiæ in lower extremities for one year, slight fatigue in walking for two years, and during last four months, amblyopia and incontinence of urine. Slender physique; mot. and sensibility normal; knee-phenomenon absent.

R. Pupil 5 *mm.*
L. Pupil 3 *mm.*
} Iridoplegia reflectica, optic-nerve atrophy of both eyes, slight convergence reaction; vessels normal in calibre.

Feb. 26, 1882.—R. E., fingers at 6 *m.*; 2.25 D., V. $\frac{6}{36}$, Jg. 6. L. E., V. $\frac{6}{60}$, Jg. 19, concentric limitation of visual field.

June 8, 1882.—R. E., V. $\frac{6}{60}$; L. E., fingers directly at eye.

Nov. 16, 1882.—R. E., fingers at 20 *cm.*; L. E., appreciates light at 6 *m.*; projection only above and to the outside.

Jan. 3, 1883.—R. E.
L. E.
} Quantitative perception of light; the arteries remained unchanged as long as he was under observation; the veins on left side appeared to be larger.

March 11, 1883.—Only slight appreciation of light remaining on either side; the veins of left side, especially those below, markedly dilated.

March 31, 1883.—Condition same as on March 11, '83.

Case 3.—Charles L., sixty years, saw-maker. Lancinating pains for fourteen years; for several years paræsthesiæ of lower extremities; diplopia for fourteen years; amblyopia for thirteen years; for ten years, bowel and bladder difficulties; for five years, inability to walk. Strong physique; sensibility and mot. normal; knee-phenomenon absent; ataxia in highest degree. Pupils: L. E., 4 *mm.*; R. E., 5 *mm.*; do not react. Optic-nerve atrophy of both eyes; papillæ seem diminished in size; vessels contracted.

Case 4.—Michael Ohngemach, fifty-five years, shepherd. Patient came into hospital in very destitute condition; history de-

fective ; walked badly for five years, and during last year could not walk at all ; bladder disturbances for many years, which have become acute in the last months ; blind for four and a half years. Patient marasmic; paraplegia of lower extremities; urine purulent ; knee-phenomenon absent ; iridoplegia of both sides ; pupils 7 *mm.*; left ptosis, double optic-nerve atrophy ; vessels somewhat diminished in size. The autopsy (Prof. Kundrat) demonstrated, in addition to general marasmus, cystitis diphtherit. and other pathological changes in the viscera : " degeneratio grisea funiculorum posteriorum et œdema medullæ spinalis præcipue partis lumbalis, atrophia nervorum opticorum et tractuum." The tracts were changed to thin ribbon-like bands ; the microscopical examination of the nerves demonstrated that nothing was left of their nerve-fibres.

Case 5.—Franz Kraus, forty years. Extract of the patient's history of November 12, 1880 : For three years had undergone heavy bodily exertions ; had lancinating pains and paræsthesiæ in lower extremities for three years, frequent girdle sensation and *crises gastriques* for one year ; during the last months disturbances in defecation and urination, discoloration of optic nerves of both sides, some atrophy of the muscles of the lower extremities, knee-phenomenon absent.

Dec. 2, 1882.—Patient has become an opium-eater ; complains of persistent pains in the lower extremities ; great atrophy of both lower extremities ; great diminution of motility ; sensibility much weakened. Pupils do not react ; R., 6 *mm.*; L., somewhat smaller ; double optic-nerve atrophy ; L., quantitative appreciation of light ; R., amaurosis ; vessels somewhat diminished in calibre. The autopsy (Prof. Kundrat) showed " gray discoloration of the column of Burdach in the med. obl., degeneratio grisea funicul. medullæ spin. (tab. dors.)." The optic tracts were diminished in size on transverse section ; the microscopical examination confirmed the diagnosis of spinal-cord disease ; in the left optic only a few intact nerve-bundles can here and there be found.

Case 6.—Chas. Wr., forty-three years, laborer. Lancinating pains and paræsthesiæ in lower extremities for one year ; bowel and bladder difficulty for ten months ; amblyopia for six months ; strong physique ; motility and sensibility normal ; tendon reflexes absent ; pretty extensive ataxia. Pupils 4 *mm.* in diameter, reflectically immovable ; atrophy of both optic nerves ; vessels normal ; right quantitative appreciation of light ; left V. $\frac{5}{10}$; cannot distinguish green (fig. 5).

CASE 7.—Theresia L., forty-four years. Hemicrania for six years, which has diminished appreciably in the last few months; lancinating pains and paræsthesiæ in lower extremities for four years; during last few months bowel and bladder difficulties; for three weeks amblyopia especially of R. E.; patient sees better in the evening. Very strongly built; sensibility and motility normal; tendon reflexes absent; very little ataxia. Pupils reflectically immovable; R. $3\frac{1}{2}$ *mm.*, L. $2\frac{1}{2}$ *mm.*; double optic-nerve atrophy.

March 16th.—R. E. = 0.50 D., V. $\frac{6}{18}$; +2.50, Jg. 5; only recognizes blue (fig. 3). L. E., V. $\frac{6}{6}$; +2.50 D., Jg. 1; recognizes all colors.

May 16th.—R. E. = fingers at 3 *m.*; L. E. = $\frac{6}{6}$; Jg. 2.

CASE 8.—Joseph Schm., thirty-three years, clerk. Ten years ago had ulcer and bubo without secondary symptoms; lancinating pains for four years, cramps in intestines and stomach (crises gastriques) for three years, paræsthesiæ in lower extremities for two years, bladder difficulty for three years; two years ago had diplopia with subsequent strabismus, which disappeared of itself in a few months; vision is blurred for more than one year, and for several months the patient became easily fatigued by walking; girdle sensation for five months, impotence for four months; has two healthy children. Tolerably strong physique; motility and sensibility normal; knee-phenomenon absent; evident ataxia. Pupils: R. 4 *mm.*, L. 3 *mm.*; L., slight paresis of the rectus externus; double optic-nerve atrophy. R. E., fingers at 3 *m.*; insensitive to green; diminished sensibility for red (fig. 2). L. E., quantitative perception of light.

CASE 9.—Anton O., thirty-eight years, servant. Lancinating pains and paræsthesiæ for three years; for two years arthropathy of right knee (arthropathie des ataxiques); motility normal; sensibility of lower extremities diminished; tendon-reflexes absent; little ataxia; amblyopia for one year. Pupils, 4 *mm.*; R., minimum reaction to light; L., iridoplegia reflectica; double optic-nerve atrophy.

Oct. 1st.—L. E., fingers at $1\frac{1}{2}$ *m.*; distinguishes yellow and blue.
R. E., fingers at 30 *cm.*; appreciates only blue.
} Concentric limitation of visual field.[1] Vessels normal.

[1] The visual fields which were taken on March 13, 1882, are entirely normal, but unfortunately their corresponding visual tests have been lost.

Oct. 22d.—L. E., fingers at 70 *cm.*; R. E., fingers at 8 *cm.*

Nov. 5th.—L. E., fingers at 25 *cm.*; veins (especially the lower) appear to be larger; R. E., fingers seen at 6 *cm.*

Jan. 14, 1883.—L. E., fingers at 10 *cm.*; veins decidedly larger; R. E., fingers at eye.

Jan. 28th.—Fingers at 50 *cm.* L. E., much greater concentric limitation of visual field than on Oct. 1, 1882; R. E., fingers at 10 *cm.*

March 20th.—L. E., fingers at 10 *cm.*, sees only blue, one vein below has double the calibre of a normal vein; R. E., motion of hand immediately in front of eye.

Case 10.—Moritz Gr., traveller, twenty-five years.[1] No syphilitic history. Occasional vertigo three years, strabismus two years ago, which disappeared after three months; two years ago decided paræsthesiæ in the upper extremities, which lasted some months; bladder trouble for one and a half years; during the last year intense feeling of fatigue at night after only slight exertion, just as if "he had walked many hours." Lancinating pains for eight months; frequent emissions; precipitate ejaculations of semen; for two months paræsthesia in soles of feet. Weak physique; sensibility and motility normal; normal tendon reflexes. If any, the patellar reflex somewhat increased; some ankle clonus; no ataxia. Pupils: R. 2½ *mm.*, L. 3 *mm.* in diameter, react promptly; both opt. discs show gray-white discoloration. Vessels normal in number and size. L. E. 4½ D., V. $\frac{6}{6}$, Jg. 3; visual field almost normal; recognizes all colors. R. E., fingers at 4 *m.*, Jg. 8 (fig. 4).

Cases 1, 2, 6, 7, 9 were observed at the eye-clinic, 4, 5, 8, 10 at the medical division, and 3 at the Home for Incurables.

As is seen from the foregoing cases, *both* eyes were constantly affected, and in every case in different degree. The difference is very great, for example in the eyes of case 6, where the left eye had V. $\frac{6}{60}$ and the right had only quantitative vision. It was never observed in tabes that one optic nerve was completely atrophic, while the other eye enjoyed perfect vision.

The ophthalmoscopic appearances are always marked

[1] The diagnosis of tabes was confirmed by two local specialists.

when the visual disturbances begin. Förster (1) says: "I have never been able to follow up the gradual atrophy; in the tabetics whom I have seen, great as their number is, I have always found the atrophy already established." The essential and—as we shall see later—the only essential is the discoloration of the papilla; the latter is either of a grayish-, bluish-, or greenish-white, but not altogether white —at least not during the progress of the atrophy,—never "chalky," if any thing rather "*nacrée*" (mother-of-pearl lustre) Charcot (11). The contours of the papilla are always sharp, as sharp as the contours of the full moon in relief against a cloudless sky at night, to which comparison I am tempted to add the color of the moon as a third resemblance. "Should the atrophic process occur in a papilla with physiological excavation, the excavation is in the first period distinctly demarcated and retains its steep margin; only the difference in color is missing, inasmuch as not only the floor of the excavation but the entire papilla exhibits a bluish-white color." "Through the atrophy the lamina cribrosa appears more distinct and becomes visible in a larger area. The papilla then appears covered by bluish-gray angular patches, between which lighter shining white strands remain, which correspond to the connective-tissue trabeculæ, while the spots represent the atrophic nerve-bundles" Leber (2).

The condition of the papillary vessels is very characteristic. That with atrophy "the most important and earliest developing symptom is attenuation of the vessels," as Mauthner (3) claims, has been questioned by Leber—at least in genuine atrophy, whereas in neuritic atrophy the statement is correct—because the vessels are subject to variations in the normal condition.

In reality matters are as follows:

In the beginning of the process, when vision is but slightly diminished, no change is found aside from the discoloration of the papilla. If the process has already reached a certain intensity and the visual power is considerably diminished, the vertical vessels are found intact, but sometimes the transverse vessels are found in fewer

number. If the atrophy be already far advanced (from 1 to 1½ years, sometimes earlier, dating from the beginning of the trouble), one sees one or more veins—usually of the lower—wider than normal; one believes himself to be mistaken, but possibly after four weeks this vessel (or vessels) appears remarkably wide, and may after a longer or shorter period present twice the width of a normal vein. It must be accentuated here that these tabetics had no brain-symptoms of any kind, so that, aside from the sharp contours of the papilla and its vessels,—the dilated veins being also sharply outlined,—the supposition of optic neuritis in consequence of a cerebral disorder must be altogether excluded. I saw the progress of vascular dilatation very distinctly in cases 2 and 9, and have made references to this in the histories. After the entrance of such a wide vessel into the retina, the vessel remains dilated for some distance, to gradually assume the calibre of the other retinal vessels. After a duration of the optic-nerve atrophy for years the papilla is often found decreased as a whole and the vessels narrowed, but the pathological changes of the latter cannot be remotely compared to those which commonly follow papillitis. I have no experience whatever as to the mode in which the wide veins after years become narrow again, nor do I know if they become narrower at all.

The observations here related were made in the direct image with an ophthalmoscope of feeble illumination, and they were compared with such of the eyes of normal persons. At all events, the relations are so marked that a comparison with normal eyes is not essential.[1]

The ACUTENESS OF VISION is not "in direct proportion to the ophthalmoscopic appearances"—Stellwag (4). Two eyes, of which one had V. $\frac{6}{18}$ and the other could count fingers at 1 *m.*, can not be differentiated by the ophthalmoscope; this was indeed best seen in the eyes of one and the same patient, in one of which he had V. $\frac{6}{60}$ and in the other only quantitative perception of light (case 6), the papillæ being

[1] Dr. Dimmer, assistant physician, has obligingly assumed the task of reviewing and confirming the ophthalmoscopic conditions. I take this opportunity of expressing my thanks to him.

equally discolored and the calibre of the vessels presenting no noteworthy differences. If the atrophic process has begun the visual acuteness sinks within a few months to a minimum (fingers counted from $\frac{1}{2}$ to 1 *m.*), decreases gradually till only quantitative perception remains, and ordinarily remains stationary at this point; rarely does complete amaurosis occur.[1] The left eye in case 2 sank in the course of three and a half months from V. $\frac{6}{60}$ to perception of the finger at the eye, the same occurring with the right. The slow diminution of vision after it has reached a certain (low) grade is exemplified in case 9. At one time it even appeared (Jan. 28th) as if there was improvement; the visual test made several weeks later did away with this illusion. In case 3, finally, we see that an atrophy may exist for thirteen years without leading to complete amaurosis. The remark may here be made that the condition of visual acuteness in tabes differs from that of multiple sclerosis, inasmuch as with the latter it more rarely sinks so far as with tabes; it usually remains stationary at a certain stage (fingers at 2 *m.* to 5 *m.*). Thus a patient with multiple sclerosis was discharged last September and returned to the hospital seven months later, his visual power (fingers at 3 *m.*) not having deteriorated. An intelligent teacher of music suffering from the same affection states that his visual impairment has not altered for one and a half years, he seeing fingers at 4 *m.* The anatomical explanation of this fact will be given in the sequel.

FIELD OF VISION.—"If an atrophy begins with a central defect or central scotoma," this indicates, "that we are not dealing with a tabetic atrophy" (Förster). But also the visual field with "sector-like" defect does not indicate tabes. The characteristic visual field is the one with concentric limitation, as shown in case 8, (figure 2). With tabes dorsalis the entire optic nerve is uniformly affected by the atrophic process. The most peripheral portions of the

[1] It happens very rarely that the atrophy remains stationary half way and then advances anew after some years; I have observed this in one case in which the tabes also seemed to have remained stationary, at least the lancinating pains were said to have ceased several years in the forty-seven-year-old patient.

retina, which also normally have a lesser visual power, become functionally disabled immediately with the beginning of the illness; later, those nearer the centre. We might suppose that if the muscles of the arm were attacked by a degenerative process, the most frequently used muscles would retain their motility longest; in the same way the central—most practised—portions lying around the macula retain their functional ability longest, while the portions far from the centre see no longer, although the fibres going to the latter are not more atrophic than those going to the central portions of the retina. Such great concentric limitation as that shown in figure 3, is a great rarity with V. $\frac{6}{24}$. We cannot assume that the axial optic-nerve fibres are intact and the peripheral ones atrophied, since Samelsohn (5) and Vossius (6) have shown by their pathological researches that the fibres which are central in a part of the nerve distant from the eyeball (in the region of the entrance of the central vessels) lie in the temporal side of the nerve nearer to the globe. It cannot, therefore, be that form of atrophy described by some authors, in which the peripheral fibres are destroyed and the central ones remain. With multiple sclerosis a visual field with pronounced sector-like defects is often found.

A very important diagnostic feature is COLOR-BLINDNESS; or, as we would prefer to say more correctly, INSENSIBILITY TO COLOR, and diminished sensibility to color. It is a constant symptom of optic-nerve atrophy, and may be very plausibly explained by asssuming with Schirmer and Schön (7) "that the greatest energy of the color-sense is necessary for the appreciation of green, the weakest for the appreciation of blue; or, to express it better, green excites the optic-nerve fibres the least, red more, blue the most." It may be incidentally remarked that we do not love the green in nature so much for the reason that our eye is accustomed to it from the earliest childhood, as because it irritates the eye less. A Munich artist with normal color-sense stated that he did not know any milder tint than a "light green." When atrophy of the optic nerve occurs, and the fibres are but moderately affected, they become

insensitive to that color which excites them least, viz., the green (cases 6 and 8); with a more intense affection red disappears, then yellow, and finally only the blue remains. This last color the patients see even when their visual power is very small, as, for example, in case 9, who could recognize fingers only at 10 *cm.*, but appreciated a blue paper as such. It has been above remarked that the more peripheral a part of the retina, the less visual power must it have; we cannot, therefore, be surprised to find that the visual field for green appears to be concentrically limited as contrasted with that for white, because the visually weak, most peripheral parts of the retina do not react on the but slightly irritating green. If, now, an atrophic process begins in the optic nerve, peripheral portions which previously were sensitive to green become insensitive to the same, and only the macula portion will be able to recognize green (fig. 4). This process continues: the part referred to becomes first less sensitive, and then altogether insensible to green. In the meantime, the visual field for red has begun to contract (see fig. 5); it becomes reduced to the central portion; this portion still distinguishes red. The process continues still further: the macula region becomes less sensitive to red—which appears brown to it,—finally insensitive, and ultimately the perception of blue remains only in a small central part of the field of vision. Meanwhile, while one color after another disappears from the visual field, the field for white has considerably contracted (fig. 3). It is, therefore, not only the case that "the appearance of color-blindness has been occasionally noted," as Leyden (21) says, but color-blindness is a postulate of tabetic atrophy, and a differential point from partial atrophy—hemianopsia—Mauthner (8). It is clear that with the latter the color-perception of one half is altogether destroyed, as the optic-nerve fibres, which supply it, have become altogether incapable of conduction; adjoining the blind portion of the retina there is, however, a well-seeing portion with complete visual power, sensitive to all colors, because the part of the optic nerve which supplies it is entirely normal. Here I may be permitted to refer to the following case: a patient with

retinitis pigmentosa had the normal visual field for white; his visual field for green was limited to the macula portion; the function of the peripheral portion of the retina was, therefore, not so much weakened that it—as commonly is the case—could not perceive white, but for green it was insensitive.

The subjective condition of tabetic patients with optic-nerve atrophy is characteristic. Their first symptom is the "fog," which is remarked by nearly every one of them; some speak of a "twilight" which seems to continue throughout the whole day. The fog is not peculiar to atrophy as some believe, patients with cataract and other diseases of the eye also complaining of it. I cannot agree with the view of Samelsohn (5), who declares the fog to be a phenomenon of irritation; it is against this view that the fog, which is at first a very faint one, is described by patients with advanced atrophy, with whom every nerve-fibre irritation may be safely excluded, as being dense, and right before the eye. There is also opposed to this the case of optic neuritis, in which the fog was complained of only when the atrophy had begun to develop. The tabetic patient with atrophy is so much absorbed by his eye-trouble that he forgets the existence of his other less troublesome symptoms; he does not wish to be convinced that he has a nervous disease; his lancinating pains he considers to be rheumatic, and his bad gait he attributes to his bad vision. In later stages, as Förster remarks, the feeling of contentment of the patients is noteworthy, with their never-failing hope that they will finally improve; and even when they are completely blind they deceive themselves and others about their condition. One patient told me joyfully that she could see her fingers distinctly when before the eye, though she could not see even the hand of another person.

As to the CONNECTION OF THE OPTIC-NERVE ATROPHY WITH TABES very different views prevail. Some (Erb, Græfe) maintain that there is no anatomical connection between the optic nerve and the posterior column which could explain the extension of the process from the spinal cord to

the eye, but that it is one and the same pathological process which affects two separate regions. Others have sought for a connection by different methods, but have failed to find it. Rieger and Forster (9) have very recently published a paper in which they claim to discover a patho-anatomical connection by means of the sympathetic; they designate as a spinal optic-nerve affection one "which appears by means of a vaso-motor disturbance in direct dependence on the primarily diseased parts of the spinal cord." As plausible as this view seems to be, it is not yet—one must say "unfortunately"—supported by clinical and experimental facts. No one has yet found the slightest vascular disturbance with beginning tabetic atrophy (with good visual power), and it would be very remarkable if the central vessels and no other branches of the carotid were to be affected by a sympathetic disturbance.

Schultén (10) has recently shown, in an article on cerebral disorders and their influence on the circulatory conditions of the eye, that the interruption of the fibres of the sympathetic has no influence whatever on the circulation in the eye; and in two rabbits in whom the cervical sympathetic together with the sup. cervical ganglion was extirpated,[1] I could not find, either immediately or after two and a half months, the slightest changes in the ocular background.

All this conflicts with the view of Rieger and Forster. If we further bear in mind that the optic-nerve atrophy sometimes precedes the commencement of the initial symptoms of tabes by years, and where we have not the slightest reason to suspect a disease of the posterior columns, we will have to abandon the idea that there is an influence of the spinal on the optic disorder. It would be more plausible to say that with a person who has a disposition to sclerosis of the central nervous tissues, the cord becomes diseased first, and later and independently, the optic nerves, or *vice versâ*; and if somebody objectingly remarks that it is strange that of all the peripheral nerves the optic nerve only becomes diseased, we may with Charcot (11) answer, that the texture of this

[1] Dr. Jul. Wagner, assistant to Prof. Leidesdorf, kindly attended to the operative portion of the experiment.

nerve, before all others, is remarkable by its resemblance to the structure of the central nervous fibres. Also the genuine—that is, the so-called genuine—atrophy, where we know nothing of the cause of the optic-nerve disease, may be ranged here. There are persons who have a tendency to disease of the connective tissues of the liver and kidney; other "connective-tissue individuals" there are who incline to sclerosis of the central nervous system. Of this group one member may be affected with optic-nerve atrophy alone, a second with optic-nerve atrophy and posterior spinal sclerosis, and a third with the latter alone. In the first case we are compelled to believe that the spinal cord resists the disposition to connective-tissue formation, and in the third case we must believe the same of the optic nerves. Besides, the genuine atrophy is much rarer than is generally believed. Thus Uhthoff (15) in twenty-four cases of pure genuine atrophy found the knee-phenomenon absent seven times; of these seven, four had myosis: with the other seventeen who had the knee-phenomonon, two showed absence of the pupillary reaction, and in three the deterioration of vision began with a central scotoma (therefore probably retrobulbar neuritis).

The pathological process in tabetic atrophy begins simultaneously in the nerve, chiasm, and tract (Leber), or it affects the peripheral segment and "extends with a sufficiently long duration beyond the chiasm as far as the corpora geniculata" Stellwag (4). The tracts are then found changed to flat "grayish" bands, as they were, for example, found in case 4. By the shrinkage of the nervous tissue the intervaginal space of the optic nerve "is changed to a broad ring-shaped sinus" (Jaeger).

Under the microscope there are found, in the atrophic optic nerve, changes similar to those of the sclerosed posterior columns; if one has the opportunity to obtain parts of both organs from the same individual for microscopical examination, this is particularly distinct; here as there is seen disintegration of the nerve fibres to connective-tissue fibrillæ; here as there are seen slight increase of the connective

tissue and slight thickening of the adventitia of the large vessels, and occasionally corpora amylacea.

It is well known that with the atrophic process, first the myelin and then the axis-cylinder disintegrate into connective-tissue fibrillæ: this, as I believe, explains why we find the papillæ discolored even with almost undisturbed visual power, and that we never succeed in following up the gradual discoloration. For as long as the axis-cylinder is intact, so long the visual power is not specially affected; in accordance with this we find with V. $\frac{6}{6}$ (case 10), on ophthalmoscopic examination, a discolored papilla; we are justified in making the diagnosis of atrophy, there being atrophic degeneration of the myelin. This circumstance, which has been brought into relief in the case of the optic nerve by Charcot (11), and for the rest of the nervous system by Ribbert (22), explains why, as above stated, the visual power in multiple sclerosis remains stationary at a certain point, and does not altogether disappear as with tabes.

We have now come to the anatomical discussion of the ophthalmoscopic appearances of the vessels. I said above that the vessels are at first normal; after a longer duration one or more of the veins dilate remarkably, and in later years we find a slight change of the vascular lumina. This is to be explained, anatomically, as follows:

With the atrophic process, the part of the optic nerve over the lamina cribrosa, shrinks "to a thin layer of fibrous tissue," as no powerful connective-tissue framework "can give the tissue support." Toward this process the arteries, which can be compared to thick, hard-rubber tubes, remain quite indifferent; this is different with the veins. These at first, perhaps, remain unchanged, but when the nervous substance which surrounds the loose connective tissue adjoining the venous adventitia shrinks, a space must be formed between the vein and the shrunken nervous tissue, which would remain void if it were not filled out by the gradually expanding vein; this latter acts like a soft-rubber tube through which fluid runs, and which is embedded in a matrix; if the matrix around the rubber vessel decreases, the vessel will fill out the empty space, expanding to its utmost possible limits.

That this dilatation of the veins only occurs after the process has lasted a certain time, and when the visual power is almost gone, is evident from the foregoing. The part of the optic nerve visible with the ophthalmoscope is composed in its greatest portion of axis-cylinders; these being more resistent than the myelin, disappear, as previously stated, much later than the latter; then visual power becomes entirely lost, and it becomes possible for the venous dilatation mentioned to occur. A similar relation is observed with the sclerosing process of the vessels in the brain and spinal cord; "they are at first, and for some time further on, intact, as far as the microscope shows, with the exception that they are preternaturally wide" (Ribbert); and we may add that this also applies to the eye, as far as the ophthalmoscope permits a conclusion. The vessels are probably, as Adamkiewicz (20) states, the medium of the sclerotic process, but with this they themselves remain nearly intact.

For the sake of completeness, I shall waste—unfortunately but waste—a few words about the therapeutics of tabetic atrophy. For whether we give strychnia or potassium iodide, santonin or silver preparations, while the patients feel subjectively bettered in their general condition after each of these drugs, the eyes, and this they themselves will add sadly but hopefully, "do not at all seem to improve." Electricity only serves to treat these patients for a time without medicines. And there thus remains for the physician nothing more—as he cannot here even treat, as with the other symptoms, symptomatically—than to keep up the hope of the patient that there finally will be some change for the better; and in few diseases are the patients so easily solaced with such hope as in tabetic atrophy.

II. THE PUPIL.—The disturbances of the pupil in tabes are: 1, reflex iridoplegia; 2, absolute (*total*) iridoplegia; 3, myosis; 4, inequality of the pupils. Each of these symptoms, when found in an individual, justify the physician in enquiring after tabes. Besides these four pupillary changes, another is mentioned by some authors as found in the initial stage of tabes, viz., bilateral mydriasis; I have myself seen very wide pupils (4–6 *mm.*), but never so wide that

one could speak of mydriasis. This symptom would have to be interpreted as an irritative manifestation of the cilio-spinal centre, analogous to the increased knee-phenomenon found by N. Weiss at the beginning of tabes.

By reflex iridoplegia is understood the lack of pupillary reaction to light; with total iridoplegia the reaction on convergence is also absent (without the accommodation being therewith absent). By spinal myosis is meant the narrow pupil found with disease of the spinal cord, and which shows the following characters. It either reacts to light or not (the latter being more frequent); under atropine it dilates to medium width (4–5 *mm.*), under pilocarpin it narrows very rapidly; further the following point is characteristic, which thus far was unknown: the pupil, dilated to medium width by atropine, requires a long time (frequently 4–5 weeks) to again become as narrow as it was before the instillation of the mydriatic. The pupillary inequality is a very striking symptom, but is not so characteristic as the other disturbances, as—however rarely—it also occurs with other individuals. Of all changes in the pupil it is the most frequent; the next in frequency is the reflex iridoplegia. That spinal myosis reaches the highest percentage with some authors is to be explained by the fact that moderately wide pupils are usually not at all examined with regard to light-reaction, and because pupils measuring 3 *mm.* are already designated as myotic, which is really improper, because with many healthy persons with moderate illumination by daylight the pupils show no larger dimensions. Myotic pupils are frequent, but they are not necessarily devoid of reaction, for example:

Case 11.—Peter W., forty-five, formerly an actor, afterward hair-dresser; never had syphilis; practised onanism from earliest childhood; lived a most dissipated life; married sixteen years; has no children. Lancinating pains and paræsthesiæ in lower extremities for five years; for four years frequently experienced the girdle sensation; difficulty in walking for the last three years; urinary difficulty for two and a half years; impotence for six months. Both pupils about size of head of pin, but left a little larger than right; left pupil reacts on artificial illumination, right pupil re-

flectically immovable; knee-phenomenon absent; motility normal; sensibility diminished on right and normal on left side; Brach-Rhomberg very well marked.

The next a case of iridoplegia reflectica.

CASE 12.—Johann M., thirty-eight years. Had lues sixteen years ago; had undergone fourteen years ago every privation during the campaign; impotent for nine years; for four years slight fatigue after but short exertion; lancinating pains for one year; girdle sensation for two months; cramp-like pains in the stomach and abdomen (crises gastriques?); strongly built. R. pupil $4\frac{1}{2}$ *mm.*, L., 3 *mm.*, reflectically immovable, prompt reaction on convergence; V.=$\frac{6}{6}$ on either side; sensitive to pressure over vertebræ, from middle of dorsal to lumbar region. Knee-phenomenon on left side quite normal, but very much diminished on right side; sensibility and motility normal; slight ataxic phenomena.

The next is recorded as a case of absolute iridoplegia.

CASE 13.—Joseph B., coachman, forty-two years. Lancinating pains for many years; urinary disturbance, and paræsthesiæ in lower extremities for one year; girdle sensation for one month; bad gait for eight months; strongly built. Pupils 4 *mm.* in diameter; on Nov. 10, 1882, reflectically immovable; react slightly on convergence; on Jan. 20, 1883, wholly immovable; preserved accommodation. Sensibility and motility normal; tendon-reflexes absent; increased superficial reflexes; decided ataxic walk; urine alkaline and cloudy.

Two cases of pronounced spinal myosis.

CASE 14.—John E., post-officer, fifty-two years. Has had lancinating pains for sixteen years, difficulty in walking for eight years, and for four years, in fact, the patient cannot walk at all; paræsthesiæ for six years, bladder disturbance for three and one half years, and impotent for six years; never had lues; emaciated person; upper extremities normal, but very much diminished localization sensation in the lower extremities; knee-phenomenon absent; motility still good; patient cannot stand. For the last four years the patient noticed that his pupils were diminishing in size, and fears that as a result of this he will become blind. R. pupil about $\frac{1}{4}$ *mm.*, L. about $\frac{3}{4}$ *mm.*; both immovable.

CASE 15.—Ferd. Joseph F., thirty-seven years, tailor. Came into hospital on account of an inflammatory œdema of lower extremities; attention having been drawn to the case on account of the pin-head size of the pupils, we discovered on inquiry that he suffered for the last two years with lancinating pains and paræsthesiæ in the lower extremities; knee-phenomenon absent; superficial reflexes increased; sensibility and motility normal.

Before proceeding to a closer discussion and explanation of the pupillary symptoms, it may be well to record a few anatomical data. The motions of the pupil are under the control of three nerves, which pass to the eye from the ciliary ganglion: they are the short root (from the third pair), the long root (naso-ciliary branch of trigeminus), and a branch from the cervical portion of the sympathetic. The fibres of the latter are said to take their origin from the cilio-spinal centre of Budge, between the seventh cervical and second dorsal vertebræ, then to unite in the superior cervical ganglion from which the vaso-motor and musculomotor fibres for the dilatator iridis are said to emerge. The centre for the oculomotor nerve participating in the pupillary movements, according to Hensen and Völkers, lies between the third ventricle and the aqueduct of Sylvius, so that from before backward we would encounter: first, the centre for the ciliary muscle, then that for the pupillary sphincter, and, finally, that for the internal rectus—Leeser (12). The views as to the seat of the reflex centre interpolated between the oculomotor and optic nerves differ. It may be just here mentioned that Longet and Budge locate the reflex centre in the anterior pair of the corpora quadrigemina.

Of the three nerves, the oculomotor is "by far the most important; its integrity is a *conditio sine qua non* of physiological movement"—Arlt, junior (13). The sympathetic and trigeminus participate only under abnormal circumstances. Thus, according to Cheauveau, active pupillary dilatation ensues on irritation of the posterior spinal nerve-roots; according to Notta this occurs with trigeminal neuralgia, further in some sensitive individuals when they are yelled at, and—according to my own experience—in spinal irritation on touching the hyperæsthetic skin, etc.

We may now enumerate the phenomena occurring after the exclusion of any one nerve. If the oculomotor is divided, permanent dilatation occurs, which is increased by irritation of the sympathetic and trigeminus; according to Arlt, Jr., division of the latter nerve produces dilatation of the pupil, after some seconds contraction follows, and this in higher degree than after division of the sympathetic; this contraction occasionally disappears already after half an hour. The division of the superior cervical ganglion of the sympathetic has yielded different results to different experimenters. In the case of two rabbits in which a large part of one cervical sympathetic together with the ganglion had been extirpated, we could note no change either in the mobility or size of the pupil on the operated side; of course this cannot be accepted as conclusive for the case of man. On the other hand, distinct dilatation of the pupil has been observed in diseases of the sympathetic where there was pressure on this nerve, etc.

Under normal circumstances contraction of the pupil follows the influence of light, convergence, and accommodation; dilatation follows the cessation of the action of light and of convergence.

With reflex iridoplegia the reaction to light is wanting; as the optic and oculomotor pairs are otherwise intact, it is believed (Hempl, 14) that the cause of this disturbance lies in that reflex centre whose location we are at present not accurately acquainted with. Now what morbid process are we to suppose as occurring in this reflex centre? A sclerotic process? Is it permissible to believe that in all cases of reflex iridoplegia the rest of the brain is intact, and that that—certainly minimal—locality of the reflex centre and only this is sclerosed? I could offer a different explanation. I have observed in many patients who were down with severe pneumonia or typhus (without meningeal symptoms), that light failed to produce pupillary reaction; if the patients recovered, the movements of the pupil following light returned. It is further known that in deep sleep, artificial light, as well as daylight, produces no reaction of the pupil; with light sleep this is not the case. Both facts

can be explained by this: that the irritability of the central nervous system—pathologically in the former, and physiologically in the latter case—is so much lowered that the most delicate of all reflexes, the pupillary reflex, has lost its function toward light. The pupil is like a fine balance—the slightest irritation produces a reaction, the slightest interference completely suspends its function.

When we now recollect that the tabetic is a "connective-tissue individual," that his central nervous system *in toto* is inclined to sclerosis, which, it is true, appears as a distinct anatomical process only in the posterior columns (and in the optic nerve), but that certainly also the rest of the nervous system undergoes a change which sometimes manifests itself in "hardening of the brain"—an anatomical expression for which as yet any anatomical basis is wanting,—it must be confessed that it is proper to speak of a diminution of nervous excitability in tabetics, which, while too slight to produce coarse functional disturbances, suffices to disturb the sensitive reflex mechanism of the pupil, that most delicate of æsthesiometers. Women, as a rule, have a more readily excitable nerve-centre than men, and Möli (17) reports that the light-lame pupils of men remained immovable on sensory irritation of the periphery, while in women they often responded by dilatation. I hence believe that we cannot attribute reflex iridoplegia to any direct anatomical basis, but that we must assign it to the generally reduced irritability of the brain due to a morbid process. If total iridoplegia develops from reflex (case 13), we must say that the capacity for reaction has suffered a further diminution, inasmuch as the pupillary contraction which accompanies contraction of both internal recti also remains absent. We cannot suppose the existence of a paralysis of the sphincter, for in this case pilocarpin would not be able to produce a reaction; indeed, in these very cases we see perhaps a more rapid contraction of the pupil than in health. A case may be here referred to which, while not properly belonging here, owing to the absence of nervous symptoms, is calculated to prove of general interest.

Catherina F., twenty-six years, cashier, noticed for about four months that her left pupil was larger than her right; this she at first discovered in the disturbing dazzle of gaslight, but paid no further attention to it since it did not inconvenience her. Lately the "dazzle" became more marked, and on that account she comes for treatment. The girl is a healthy, strong person, and alleges she never had syphilis. In regard to the central nervous system and the other organs there are no abnormal manifestations. R. E., V. $\frac{6}{12}$; + 0.50 V. $\frac{8}{8}$, Jg. 1 in 12 *cm.*; pupil 3 *mm.* in diameter and reacts promptly. L. E., with stenopaïc slits, $\frac{6}{12}$, Jg. 1 in 15 *cm.*; pupil 5 *mm.* in diameter, does not react either to light or on convergence; with atropine 7 *mm.* in diameter, hardly growing smaller after eight days, and on introduction into eye of one drop of pilocarpin very quickly diminished to size of pin-point. The left pupil was hence totally immovable, but still showed prompt accommodation; otherwise Jg. 1 in 15 *cm.* could probably not have been read; yet, in regard to its action with atropine and pilocarpin, this case is less clear than it was from the beginning.

A very marked symptom is the myosis. It occurs as frequently as in tabes only in progressive paralysis; it may appear in the earlier stages of tabes or later, and increases with the progressing spinal disorder. Thus an intelligent patient related to me that four years ago his attention had been directed to his narrow pupils; that he had followed their progressive narrowing since then before the mirror, and feared very much that he would become blind by their closure. With what dimensions we are to consider the pupil in a state of spinal myosis or only normally narrow it is difficult to determine, as in older people whose occupation compels them to accommodate continually, the pupils are really surprisingly narrow. The reaction to light is, it is true, frequently, but not always, a criterion. The observation of pupils under $2\frac{1}{2}$ *mm.* should always direct our attention to the possible existence of a spinal disorder.

We can discriminate between a spastic myosis, such as occurs with ciliary irritation (iritis), and a paralytic myosis, which latter occurs through paralysis of the dilatator (Leeser).

With the latter we have nothing to do in the present case. Now, the dilatator is not an antagonist of the sphincter, pupillæ in the same sense, for example, as the external rectus is an antagonist of the internal rectus; for we have seen that the normal pupillary movements occur only under the influence of the sphincter, and theoretically, therefore, the paralysis of the dilatator ought to have no influence on the pupil. But actually this is not the case. The cilio-spinal centre—to which is universally ascribed the origin of the disturbance—sends besides its musculo-motor also vaso-motor fibres to the iris, and Rembold (16) says: Given the two forces, sphincter and dilatator, as equal to zero, one factor still remains, viz.: the blood which may fill the relaxed vessels. If, now, the function of the cilio-spinal centre is abolished, the oculomotor nerve being intact, blood will pour into the paralyzed vessels of the iris; in consequence a narrow pupil (possibly 2½–2 *mm.*) results; the sphincter can contract; the dilatation on shading the eye will, however, be very slight, as the passive movement —and with such a one we have to deal in shading—is only capable with difficulty to drive the blood from the paralyzed vessels of the iris. The longer this condition remains, the slower will passive dilatation occur after slight contraction of the sphincter; the sphincter will contract spastically, somewhat as convergent strabismus occurs with paralysis of the abducens,—it will remain, so to speak, in a state of irritation. In such a state, of course, all reaction will have been lost; but it is easily seen that this iridoplegia is distinct as to its mode of origin and course from the reflex form; it is easily understood that when the persisting contraction of the sphincter is not very intense a movement of the sphincter can be provoked if a sufficiently strong irritation is employed, and this can be carried out by the holding of an artificial light before the eye in a dark room (case 11).

If atropine be dropped into a myopic eye, which drug, according to Stellwag and others, paralyzes the sphincter and excites the dilatator, the latter action of the mydriatic will be wanting, and we will have a pupil like that described

by Rembold in the case of paralysis of both sphincter and dilatator, only that it would be a little wider, because, as it appears, the dilatator is not so completely paralyzed as to be altogether inexcitable to all irritations.

The myotic pupil actually attains a width of 3–4 *mm.* after instillation of atropia ; when the action of the atropine ceases, the sphincter contracts anew, until it reaches its previous narrowness ; for this, from three to four or five weeks are necessary—the narrower the pupil the longer the time. A spastic myosis (ciliary irritation) differs from the one previously described, in that the dilatation following the use of atropine has often disappeared in twenty-four hours ; this can be particularly observed with a florid iritis. If the myosis be of a high grade, the patients complain of bad vision and feel very well after an instillation of atropine, stating that they have not been able to see so well for years as now.

We usually examine the pupillary reaction in a dark room with artificial illumination. The patient is told to close his one eye with the hand, and the examiner moves the wax candle from behind to before the eye to be examined ; in this way the disturbing factors of convergence and of other sources of light are excluded. I have often seen pupils which appeared devoid of reaction in the patient's room, illuminated from two sides with daylight, contract with artificial illumination.

It is quite clear to me that the relations of the pupil to the central nervous system are far from being revealed to us ; if anywhere knowledge begins with the consciousness of knowing very little, it is here. When one peruses the latest two large and excellent, mostly eclectic, treatises on pupillary movements of Leeser (12) and Rembold (16) one recognizes, since all experiments and views are submitted with objective clearness by them, how far we are removed from a perfect understanding. And the latest article by Rieger and Forster, who believe they have exposed all the relations of the pupil to the spinal cord, has not added very much to the clearing up of the subject.

III. THE OCULAR MUSCLES.—The disturbance of the

eye-muscles in tabes consists in paresis of one or several. It begins, if it develop at all, almost always with the very first symptom of the tabes, but at times it precedes the same by many years. Here is an example:

Case 16.—Rudolph W., forty-five years, laborer. Had syphilis twelve years ago; gradually developed strabismus eight years ago; for two years had lancinating pains and paræsthesiae in lower extremities; frequent girdle sensation and urinary disturbance for nine months; impotent for a year and a half; œdema of the feet for four weeks; strongly built; tolerably well nourished. Pupils 3 *mm.* in diameter; equally large, immovable; convergent strabismus as a result of complete paralysis of right abducens; normal visual power; knee-phenomenon absent; sensibility in lower extremity somewhat diminished; motility normal; ataxia; Bright's disease.

The paralysis very infrequently appears suddenly; usually it develops gradually, as exemplified by the previous patient, he having had at first a peculiar feeling of vertigo about the eyes; in the beginning, only occasional, then finally constant, diplopia; he then began to squint, which became more and more marked until, over three months ago, when it reached the same intensity that it shows at present. The paralysis may remain constant—the less frequent condition—or, after a presence of several months, it disappears, leaving no traces behind, as a proof of which I have in my possession the histories of some cases, but at times it may reappear again after several years.

Case 17.—Marie B., forty-six years, had diplopia seventeen years ago; for fourteen years lancinating pains; paræsthesiæ for eight years, and since four years the patient cannot go about alone; amenorrhœa for two years; great urinary disturbance for one year; never gave birth to children; never had syphilis; the diplopia had disappeared a few months after its appearance, but for about six months it troubles her again; weakly built. Left eye pupil 1½ *mm.* in diameter; rect. sup. paralyzed; rect. inf., rect. ext., and levator ppb. paretic. Right eye pupil size of pinhead; rect. ext. paretic. Motility of lower extremities normal; sensibility diminished; very pronounced retardation of sensibility;

analgesia; absence of tendon reflexes; ataxia in highest degree.

The views of authors as to the frequency of paresis of individual muscles are divergent. Charcot believes that the muscles supplied by the third pair are most frequently, the abducens less frequently, and the trochlearis only exceptionally, paralyzed. Woinow had already, in the year 1871, expressed the view that the abducens, and particularly the left abducens, was predisposed to tabetic paralysis.

Erb (23) assigns twenty-seven per cent., Möli (17), 39.6 per cent., of paralysis of the eye-muscles in tabes. These figures, notwithstanding the high authorities from which they emanate, have little value, because they must be necessarily based upon the statements of the patients.

The anatomical cause of these paralyses is located by Förster in a disease of the floor of the fourth ventricle. Otto Kahler (18), however, found at the autopsy of a tabetic who had exhibited several left-sided subsequently disappearing pareses of several of the muscles supplied by the third pair, besides other appearances, and with several interesting conditions in the brain, that the oculomotor nucleus was intact. Other authors suspect the medulla oblongata, and N. Weiss (19) a basal meningitis, to be the cause of the pareses. The fact that often only one branch of the oculomotor is paretic while the others are entirely intact; further, the course and intensity of the affection are against basal meningitis. When, for example, the patient in case 16 minutely states that his abducens paralysis developed gradually within three months without headache and without any other associated signs, a meningitis is scarcely plausible; and can we believe that there has been an exudation around a small portion of the oculomotor nerve, leaving the remainder intact, when there is paralysis of a muscle supplied by the third pair, and which disappears without further treatment in nine months; can we believe that after so long a time, the cause being peripheral, a *restitutio ad integrum* can ensue?

I would like to direct attention to another source of

information which may perhaps lead to a result. Adamkiewicz (20) has shown that the path of tabetic sclerosis is determined by the course of the arterial vessels. The vertebral artery supplies the posterior columns with blood-vessels, but it also supplies the basal ganglia of the eye-muscles with blood; these are the arteria cerebri sup. and art. cereb. inf. post.

When now a sclerotic process visible to the naked eye develops on the descending branches, is it then improbable that a similar process should affect the ascending branches of the same artery, although in less intensity and in a way that with our present methods of investigation and the little material at our disposal is not yet microscopically demonstrable? It was previously stated when speaking of iridoplegia that this must be attributed to a delicate cerebral change which is too slight to produce other symptoms. Here we would have to assume the existence of an intense though not yet demonstrable process extending along the ascending branches of the vertebral artery. This theory permits the explanation of all paralyses of the eye-muscles in tabes. If only one muscle of the oculomotor group be affected we say that the process has chiefly developed in that part of the oculomotor nucleus which corresponds to that muscle. If the paresis precedes the tabes proper by years, it would have to be assumed that the slight process affecting the ascending branches developed earlier than the descending and macroscopically visible one.

The gradual development of the noticeable paralyses of the eye-muscles also favors the assumption of such a process which would certainly develop very insidiously. How now shall we explain that the paresis, for such it is at first, becomes a complete paralysis; secondly, that the process returns after years? Let us assume that the right abducens nucleus was affected; the process will remain stationary at a certain low grade, and the patient has an abducens paresis and sees double images. He now makes—of course, unconsciously—all exertions to lose these double images; he will exert his external rectus often and intensely in order to see single; and finally will make it resume its

function. Whether new nervous channels develop for this muscle, or another nerve supplies the rectus externus vicariously, I can as little conceive with certainty as we can explain the restoration of the function of the muscles of the extremities after their centres have been destroyed by hemorrhage. Let us suppose the case that the patient—and this occurs rarely—is not able to overcome his paresis; he will have to give up binocular vision altogether, and will rather see single with one eye than double with both; convergent strabismus will then develop, owing to a preponderating contraction of the internal rectus. The above is supported by the fact that the patients declare—and this constantly—that before having become affected with a permanent squint they had seen double for a time. The repeated occurrence of eye-muscle paralyses after these have the first time disappeared completely is to be explained by this: that the sclerosing process in the spinal cord, after having for a while remained stationary, frequently undergoes a rapid intensification, with which sometimes certainly the brain also sympathizes, producing new eye-muscle disturbances which, as far as my knowledge goes, do not then disappear. In reply to the objection that it is not explicable why the facial nerve, for example, whose nucleus lies in the same vascular district as those of the eye-muscles, shows no disturbance, it is to be said that, as above referred to, the morbid process is necessarily very slight; too slight to produce a distinctly noticeable disturbance of the facial muscles, but great enough to produce a slight paresis of the eye-muscles, which merely manifests itself in diplopia. It may be here mentioned, in addition, that it has been stated by others that very slight facial pareses are of frequent occurrence in tabes.

I wish to accentuate once more that the foregoing is given only as an hypothesis, supported by all the facts at our disposal, and that the nature of the tabetic eye-muscle disturbances can be entirely explained only by the assumption of this process.

The question whether we can diagnosticate tabes from a paralysis of the eye-muscles alone must be answered nega-

tively. The eye-muscle paralyses of tabes have in themselves nothing characteristic; if a pupillary disturbance is added, we are compelled to suspect tabes, and if lancinating pains appear, the diagnosis of posterior spinal sclerosis may be accurately made.

The eye-muscle paralyses of posterior spinal sclerosis are found with no other form of spinal disease.

It may be further emphasized that with tabes nystagmus has been observed, and this with movements of the eyeball. This is regarded as an ataxia of the eye-muscles; it is rare, and not to be confounded with the persistent oscillatory nystagmus of multiple sclerosis.

Résumé: Collating all that has been said about eye-disturbances in tabes, it may be emphasized above all, that it does not often happen that a tabetic patient during his life remains free from them. They either manifest themselves in an affection of the optic nerve, or in disturbances of the inner or outer eye-muscles.

1. The optic-nerve atrophy is characterized by the sharply contoured discolored papilla with its peculiar vascular relations, by the at first rapid then gradual diminution of visual sharpness, by the concentric limitation of the field of vision, by the characteristic state of the color-sense (diminution and absence of color-sensibility). Only the visual acuteness and the condition as regards color-perception give distinct evidence of the status and progress of the affection.

2. The disturbances of the pupil consist in reflex and total iridoplegia, in myosis characterized by its reaction to atropine, and finally in pupillary inequality.

3. The paralyses of the eye-muscles develop gradually and disappear slowly. They rarely remain for life, and may recur after having disappeared; they are found with no other disease of the spinal cord.

I feel it incumbent upon me to thank most warmly the physicians in charge of the hospital divisions in which I collected the material for this treatise, Drs. Scholz and Pfleger, and particularly my respected teacher, Prof. Arlt.

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Description of the Drawings (*Plate ix*).

Fig. 1.—Normal eye. Visual field for white ; V = $\frac{6}{6}$.

Fig. 2.—Belongs to case 8. Visual field for white ; fingers at $3\frac{1}{2}$ *m.*

Fig. 3.—To case 7. The outer the visual field for white, the enclosed one for blue ; V = $\frac{6}{24}$.

Fig. 4.—To case 11. The outer the visual field for white, the enclosed for green ; fingers at $4\frac{1}{2}$ *m.*

Fig. 5.—To case 6. The outer the visual field for white, the enclosed for red ; V = $\frac{6}{60}$.

CONTRIBUTIONS TO THE STUDY OF THE RELATIONS BETWEEN CEREBRAL AND OCULAR DISEASE.

By Dr. A. NIEDEN in Bochum.

Translated by Drs. Edw. Fridenberg and A. Schapringer, of New York.

In all departments of clinical medicine the unusual attention paid during many years to specialistic studies has served to divorce to a great extent the individual discipline from general medicine.

Of late the desire for centralization—for inter-communication—is being felt, and has been well expressed in the prospectus of the new journal for internal medicine started a few months ago by Frerichs-Leyden.

In the case of ophthalmology, repeated attempts to re-establish connection with internal medicine through clinical observation, led directly to the study of cerebral pathology, as involving the most direct relations between two organs intimately associated in their origin, anatomical structure, and function.

Gowers,[1] Robin,[2] and Mauthner,[3] have collected in a very exact manner our present knowledge of this subject, while the physiological relations of the two organs has been carefully studied by Hitzig, Fritsch, Meynert; Charcot, Ferrier; Laborde, Grau, Duval; Wernike, Nothnagel, and Munk.

The words of Fontaine regarding the brain: "Obscura textura, obscuriores morbi, functiones obscurissimæ," have

[1] "A Manual and Atlas of Medical Ophthalmoscopy." London, 1879, pp. 352.

[2] "Des troubles oculaires dans les maladies de l' encéphale." Paris, 1880, pp. 600.

[3] "Gehirn und Auge." Wiesbaden, Bergmann, 1881, pp. 255.

no longer the same weight as they had when Hyrtl placed them as a motto at the head of his chapter on the anatomy and physiology of the brain.

Yet the unexplored region is still very extensive. Physiological experiment in the laboratory must needs be modified and supplemented by the careful study of symptoms at the bedside, and of lesions on the autopsy table, that more light may be shed on this still obscure department of medical science.

Led by these considerations, I take the liberty of presenting the following cases from my reçord-book:

I.—FIBRO-SARCOMA OF RIGHT CEREBRAL HEMISPHERE; BILATERAL OPTIC NEURITIS; ATROPHY OF OPTIC DISCS.

Mr. Mertens, æt. twenty-five, consulted me toward the end of February, 1878, with the following history. Since November, 1877, he suffered from periodical attacks of headache, limited to the occipital region, recurring every two to three weeks, lasting two or three days, and severe enough to prevent him from working. In the intervals he felt perfectly well. These attacks were soon accompanied by gastric disturbance, vomiting, etc. Medical advice was now sought, but his condition not improving under treatment, he applied for admission to the general clinic.

Mr. M., a stoker by occupation, is of healthy, robust appearance, and has never suffered from constitutional disease of any kind. He complains only of neuralgia affecting the right side of the occiput, but denies having received an injury of any kind. On examination of the skull no depression or fracture is discovered, but percussion causes pain and slight dizziness.

The neuralgic pain occurs with tolerable regularity once a week, commencing in the right posterior half of the head and increasing rapidly in intensity. It is accompanied by marked vertigo, obliging patient to keep his bed. After a rest in bed of two days' duration the pain disappears and patient feels well. S=1.

In the early part of March, 1878, patient complained of disturbance of vision, a scintillation before both eyes, especially before the right eye, and was transferred to my wards.

Ophthalmoscopic examination revealed choked disc, far advanced in the right eye, less marked in the left. S. oc. dextr. $\frac{1}{3}$, reads No. 4 (Jaeger); S. oc. sin. $\frac{1}{3}$, reads No. 2 Jaeger.

Examination of visual field : O. d. Perception of light good up to 20° from the centre outward, and 30° downward ; the inner and upper-outer portion of v. f. entirely wanting. O. s. Perception good outward both above and below ; v. f. wanting inward above and below—*i. e.*, the nasal halves of the visual field are completely lost.

Mental faculties unimpaired. Patient in good spirits notwithstanding severe neuralgia. Motility of all muscles and sensibility of surface normal.

Pupils of normal size, equally contracted during the attacks, reacting well to light and to movements of convergence.

A course of mercurial inunctions exerted no influence on the intensity or the periodicity of the attacks. The disturbance of vision increased rapidly. Loss of visual acuity and concentric limitation of the field progressed from day to day, so that on March 23d S. in both eyes was less than $\frac{1}{20}$. The signs of stasis increased *pari passu*. A week later fingers were recognized at 4″ by the left, at 1″ by the right eye. The v. f. of the right eye consisted of a small circle near but external to and below the centre. The v. f. of the left eye was about twice as large, situated on the outer side above and below. Thus the inner halves of the retina reacted to light only in their medial portions. On April 20th total amaurosis of both eyes.

The swelling of the discs now began to diminish, the retinal exudation to be absorbed. Pain in the right posterior half of head as severe as before, recurring every two weeks and lasting 2–3 days, during which the patient's mind was clouded, articulation impeded, and pupillary reaction slow. No elevation of temperature or increased frequency of pulse. Sensation in face and body, motion of eyes and of tongue, normal.

Patient now remembers that in October of last year a heavy door fell, striking him on the right side of the back of the head. With the exception of severe momentary pain this blow was followed by no symptoms subjective or objective, nor can any evidence of fracture be discovered at the present time.

The history of the case and *status præsens* lead us to the diagnosis of a tumor in the cranial cavity, growing slowly and in some way connected with the injury above detailed. The absence of functional disturbance in all the muscles and in the nervous system generally, with the exception of

the loss of sight, the headache confined to the right occiput, the history of an injury to this region, the extraordinarily rapid loss of sight within six weeks,—all these factors tended to locate the lesion in the occipital lobe of the right hemisphere. The diagnosis of an abscess being excluded by the long interval between the symptoms and the injury, from the intense occipital neuralgia and the affection of the eye, which is so rarely observed as a result of circumscribed suppuration in the cranial cavity, the existence of a neoplasm intimately connected with the dura mater could be diagnosed with certainty.

All treatment directed to the alleviation of the patient's headache proved unsuccessful, the pain increasing both in intensity and in frequency. Appetite, general appearance, and spirits of patient unchanged.

In the course of the following months the discs became atrophic, slightly excavated ; the retinal arteries threadlike. Pupils contracted during convergence, but were not affected by light.

On January 6, 1879, nine months later, patient had an epileptiform seizure with loss of consciousness. Similar attacks with prolonged unconsciousness recurred frequently, being preceded by an aura in the left arm, accompanied by violent clonic spasms of the facial muscles on the right side and of the muscles of the neck on the left side, so that the head was rapidly twisted toward the left side or pressed backward into the pillow, while the features on the right side were the seat of violent contortions. After each seizure the patient experienced a general feeling of debility, anorexia, and loss of memory, a new and more violent attack usually ensuing before the patient had fully recovered from these symptoms.

About July 15, 1879, the sphincters of the bladder and of the rectum began to be paretic, and weakness with a feeling of numbness was complained of in the left leg. While walking, patient swayed from side to side, moving toward the left involuntarily, and being easily fatigued.

Mental faculties unimpaired except during and after the rapidly recurring seizures. Headache constant, general debility increasing. Severe injury to the tongue during the seizures occasionally prevents deglutition for days at a time.

In December, 1879, patient was unable to leave his bed, and

had lost all power over the vesical and rectal sphincters. The left upper and to a less degree the left lower extremity was paretic and anæsthetic.

The right facial nerve was paralyzed, the pupils equally dilated, not reacting to the ordinary stimuli. The seizures often lasted three whole days, the head always being turned to the left, the eyes deviating toward the same side, with nystagmus-like movements around the vertical axis, respiration of the Stokes' type, pulse slow and intermittent.

After repeated attacks of this character, patient died on January 5, 1880, nearly two years after admission to the clinic.

I now believed myself justified in diagnosing a tumor of the right occipital lobe on the grounds already mentioned, viz.: (1) the injury to the skull had been received on the right occiput; (2) sensation of pain was felt in this region only; (3) the facial muscles were paretic on the right side, the muscles of the body on the left side only, all these parts having been the seat of clonic convulsions and showing loss of sensation; but more especially (4) the epileptic seizures pointed to an affection of their centre located in the occipital lobe; and (5) the rapid loss of sight was probably dependent on an organic change in the centre for visual impressions located in the same region.

Autopsy, 18 hours *post mortem*. On removal of the scalp the outer surface of the skull is found to be the seat of a dark-violet discoloration in the region of the right fronto-parietal suture. Opposite this point, the bone, thin throughout, adheres closely to the dura mater. On removing the skull-cap a broad cone-shaped exostosis of the lamina vitrea, $\frac{3}{4}''$ in diameter, $1\frac{1}{2}''$ in height, consisting of a homogeneous ivory-like mass with a nodular surface, is found embedded in the substance of the right lobe, out of which it was easily lifted with the vault of the cranium. In close proximity and posterior to this exostosis the parietal bone is occupied by a translucent circular depression about $\frac{1}{2}''$ in diameter, with sharp edges, and no thicker than a sheet of foolscap. Slight pressure with the nail caused a perforation. There were no Pacchionian bodies at this point, and the thinning of the bone must be attributed to a chipping off of the lamina vitrea, caused by the injury already described.

The dura mater is tense but normal, the pia mater turbid and dull.

The deep, funnel-shaped impression left in the brain-substance

by the cranial exostosis, is of a reddish slate color over an area 8 *cm.* in diameter.

Here the gyri are barely recognizable, and the finger feels a *heteroplastic* mass of the same extent, sharply defined from the surrounding substance both in color and consistence. Over the remainder of the brain-surface the gyri are normal, the sulci free from plastic exudation, the venous plexuses markedly congested.

On section through the pseudoplasm, it was found to consist of a hard tissue with a creaking sound, when cut, situated between the anterior central and posterior central convolutions, extending in the substance of the right hemisphere to the basis of the right ventricle, covered anteriorly by a very thin layer of gray cortical substance, and of the size of a goose egg.

The tumor was easily lifted from its bed by the point of the finger. Anteriorly it encroached on the anterior frontal convolutions, posteriorly it reached beyond the centre of the meridional section of the hemisphere; the mass being of the same dense, felt-like consistence throughout.

The anterior horn of the right ventricle was obliterated, in the posterior horns some serous effusion was found; the left ventricle was filled with serum.

Remaining portions of the cerebrum and cerebellum more or less anæmic, otherwise normal. Optic tracts and nerves thin, atrophic in appearance on section, of equal size on the two sides. Corpus striatum and optic thalamus of the right side compressed laterally, unchanged in structure.

On microscopic examination the neoplasm proved to be a fibro-sarcoma of strong connective-tissue basis-substance, interspersed with numerous spindle-shaped cells, presenting similar microscopic details in all its parts. The remaining viscera were apparently normal.

In this case, therefore, we find a young robust workman with symptoms of an intracranial affection arising shortly after an injury to the skull had been received. The first symptom is severe occipital neuralgia, soon followed by disturbance of vision.

Ophthalmoscopic examination discloses choked disc on both sides, leading us to the diagnosis of intracranial neoplasm. Judging by the history of the case, and the results of functional examination, we would have located the tumor

in the occipital lobe of the right hemisphere rather than in the central portion of the hemisphere, where it was found at the autopsy.

To explain the origin of the tumor, we must assume that the traumatism in the region of the parieto-frontal suture gave rise to a partial detachment of the lamina vitrea. The sharp-edged fragment, covered by the dura mater, being driven into the brain-substance, the lesion of the brain and of its membranes on the one hand, the constant irritation through the osteoplastic neo-formation on the other, supplied the necessary stimulus for pathological new-growth.

The increase in size of the exostosis, pushing the dura mater into the tumor mass and dragging on its fibres, gave rise to the intense headache. The early disturbance of vision was caused primarily by the direct pressure of the tumor. In conjunction with the epileptic seizures, observed later in the case, it may also be attributed to the influence of the increased intracranial pressure, especially of the right hemisphere, on the occipital lobe with its visual centres and intracerebral tracts.

II.—GLIOSARCOMA OF PONS AND MEDULLA ON RIGHT SIDE; ASSOCIATED OCULAR PARALYSIS; NEURITIS OPTICA OC. UTR.; PARALYSIS FACIALIS DEXTRA; HEMIPLEGIA SINISTRA.

M. Shuhmacher, æt. twenty-six, previously in good health with the exception of a slight pleuritis, applied to me for treatment at the German Hospital in London, in 1873. Patient has resided in England for five years, working in a sugar-refinery as "sugar-baker," an occupation both very laborious and unwholesome, owing to the great heat to which the workmen are exposed.

About five months ago he contracted facial erysipelas, starting from the dorsum of the nose and extending over the entire right side of the face. The attack lasted two weeks, when he resumed work. About eight days afterward he noticed a slight loss of power without pain in the left arm. Some two months ago a similar loss of power, also without pain, was noticed in the left lower extremity. Occasionally, pain was felt in the occiput, radiating toward the right temple, not attacking the left side of the head. After the

erysipelatous attack an undefinable sensation had remained in the right side of the face; during the last few weeks patient is unable to close the eye of this side, or to whistle.

With the loss of power in the left leg, patient, for the first time, experienced the sensation of vertigo. A gradual diminution of hearing has set in on the right side for two months. At present the right ear is completely deaf.

About the same time the friends of the patient noticed that his eyes were crossed, and he was unable to look toward the right without becoming dizzy. It is, however, probable that strabismus existed before the attack of erysipelas, as the patient was troubled, when descending stairs, by double vision for six months.

Headache, the patient states positively, was not noticed until after the attack of erysipelas.

Appetite and the bodily functions are satisfactory; sleep sound, not disturbed by dreams. Patient denies syphilitic infection.

Status præsens: Patient robust and well nourished. Facial paralysis on right side, the orbicularis oculi still contracting somewhat, so that the eye can be about half closed. Conjunctiva inflamed. Total paralysis of the rect. ext. oc. dextri, paresis of rectus int. oc. sin. When patient endeavors to look toward the right, the right eye never passes the median line; the left eye makes a few spasmodic excursions to the right, returning at once to the primary position. Slight paresis of the trochlearis o. d. and of the obliquus infer. oc. dext., also of the rectus super. et infer. oc. sin., motion to the right upward and downward being incomplete and accompanied by diplopia. Both levatores palpebræ sup., the muscles of the right eye supplied by the oculomotory nerve, viz: rectus internus, inferior, superior oc. dextri, and the rectus externus, obliquus super. et infer. oc. sin., exhibit normal mobility. Pupils of normal size, equal on both sides, react well to light and on convergence.

Ophthalmoscopic examination shows transparent media, normal fundus, hypermetropic astigmatism. S. oc. dextr. = $\frac{1}{3}$, oc. sin. = $\frac{1}{4}$; No 1 is read fluently on either side. V. F. normal.

Tongue is protruded to the left, but can be freely moved to either side; articulation is somewhat impaired, especially for the lingual consonants. Of late, mastication and deglutition are performed with difficulty; no food enters the larynx, but liquids are occasionally regurgitated through the nose. The movements of the soft palate are apparently normal and equal on the two sides; the uvula not deflected from the median line.

The sense of taste is preserved; the sense of smell has always been deficient.

The neuralgic pain is felt a short distance to the left of the median line posteriorly; anteriorly it reaches to a line drawn directly upward from the external angle of the eye. On the right, percussion of the skull causes more pain than on the left.

The mind is apparently clear, memory not diminished. Temperature, pulse, and respiration normal.

Two days after admission to the hospital patient suffered from marked dysphagia. Deglutition was immediately followed by vomiting and a convulsive seizure, during which the face became cyanotic, the respiration impeded, the pulse irregular in volume and in strength. These attacks would last about fifteen minutes, being separated by intervals of comparative comfort. Retention of urine also set in, necessitating the periodical use of the catheter.

Two weeks after admission there was a total paralysis of the rectus externus, obliquus super. et infer. of the right eye, and of the rectus internus, inferior, et superior of the left eye; the obliquus inferior of this eye showed paresis only as evidenced by a limitation of motion upward and outward. The levatores remained normal.

In the right eye, therefore, there was total paralysis of the fourth and sixth cerebral nerves, and paresis of one branch of the third nerve; in the left eye the fourth and sixth nerves were normal, whilst of the third nerve three branches were completely, one branch partly, paralyzed. On either side, the pupillary branch and accommodation were normal. When at rest the right eye looked upward and inward, the left eye downward and outward.

The history of the case was recorded in 1873. At that time the existence of associated ocular paralysis was unknown. The anatomical connection between the nuclei of the third and the sixth cerebral nerves had not yet been demonstrated. In explanation of the case we were obliged at the time to assume a reflex paralysis; the right eye being primarily, the left eye secondarily, affected.

Examination of the ocular fundus now showed the disc slightly swollen, its outline blurred, venous stasis without ecchymosis of the adjacent retina, the condition being more marked in the right eye, S. oc. dextr. $\frac{1}{4}$, reads No. 2. V. f. shadowy on the outer side. without actual defect. S. oc. sin $\frac{1}{3}$, No. 2.

The patient's mind remaining clear, the headache increased in intensity, the paralysis of the left extremities became more marked. The soft palate retained its mobility; the tongue deviated to the left.

Vomiting recurred frequently, always following on the ingestion of food, producing a rapidly increasing debility of the patient. He now complained of a gradual loss of sensation on the right side of the face and the left side of the body, which parts could barely be touched without the patient suffering intense pain.

The paralysis of the left extremities soon prevented him from leaving his bed; urine and fæces were voided spontaneously, the mind wandered, the speech became mumbling. During sleep the patient snored loudly, the right side of the soft palate being paralyzed. Further ocular paralyses were not noticed, but the "choked discs" were more pronounced.

Patient lay in a semi-comatose condition, interrupted by occasional attacks of convulsions, for four days, when he died in complete coma, four weeks after admission.

Autopsy, 24 hours *p. m.*—Bones of skull-cap, normal. Dura mater, tense; marked venous stasis in the arachnoidal vessels of the right hemisphere; gyri, normal. Brain-substance soft and watery; both greater ventricles dilated by serum, particularly in their anterior horns. Ependyma granular.

At the base of the brain the right half of the pons is seen to be about one half larger than the left side. Adjacent to the medulla oblongata and in the processus cerebelli ad pontem, it is also harder than on the left side. Toward the medulla its surface is translucent.

The right side of the medulla is twice the size of the left side, and exhibits a like translucency of surface.

Near the pons, two gelatinoid tumors of the size of half a pea emerge from the right pyramid, displacing the basilar artery to the left of the median line. The arachnoid over the pons is turbid and infiltrated with serum.

On the right side, the facial and the acoustic nerve are flattened out and feel harder than on the left side.

The hardness above referred to as found in the pons is limited to that portion of its substance which borders on the medulla oblongata and the pedunculus cerebelli ad pontem. Its surface is nodular.

The change in the medulla affects the right pyramid and one half of the olivary body.

As seen from above, the right half of the fourth ventricle and a small portion of the left half near the median line appear unduly prominent. Under the ependyma ramifications of blood-vessels are noticeable. The striæ acusticæ are well marked, the raphe of the fourth ventricle pushed to the left, its floor less grayish and more whitish in color than is normally the case.

The vermis inferior and the trigeminus are the seat of slight changes. No other pathological changes in the cerebrum, cerebellum, or other viscera.

On microscopic examination the tumor proves to be sarcomatous in nature, containing a great number of small cells, especially numerous in the gelatinoid execrescences, on the pyramid, and must hence be classed as a gliosarcoma.

To recapitulate the salient features of this case, we find a young, healthy man becoming suddenly affected with diplopia due to paralysis of the rectus externus of the right eye.

Facial erysipelas soon follows, after which the ocular paralysis increases, the rectus internus of the left eye becoming affected. Simultaneously cerebral symptoms, headache, etc., make their appearance.

The paralysis rapidly extends to the facial and acoustic nerves of the right side and the branch of the oculomotor supplying the inferior oblique of the right eye.

The superior and inferior recti of the left eye are affected simultaneously, presenting a picture of an associated paralysis of the movements of the eye to the right, to the outer upper and outer lower side. The remainder of the muscles supplied by the third nerve retain their function, disturbance of vision both central and peripheral being but slight.

The opposite side of the body becomes the seat of gradually increasing paralysis, first in the upper, then in the lower extremity; the increase of the paralysis is marked by attacks of vertigo.

Paralysis of the hypoglossus then ensues. The growth of the pathological process within the cranium is further marked by the appearance of dysphagia and disturbed innervation of the vesical and rectal sphincters. At the same time venous stasis at the optic disc is not at all marked.

Hence the intracranial tumor must be small. Finally the mind is affected, and death ensues seven months after the appearance of the first symptoms.

The course of the disease points to the existence of a tumor of moderate size at the base of the cranium. This tumor must have started in the nucleus of the right abducens, rapidly invading the facial and acoustic nerves, implicating the nucleus of the trochlearis of the same side anteriorly, and then growing backward into the medulla, the pyramids, and the nucleus of the hypoglossal. Having nearly attained its ultimate size, it must have exerted sufficient pressure on the fifth nerve of the same side, to produce the disturbance of sensation noticed in the face.

Already at that time it was clear to us, that the neoplasm could not have invaded the nuclei of the oculomotorius. This follows from the difference in amount of paralysis observed in the distribution of each third nerve. On the right side the branch to the obliquus inferior only was affected; on the left side the rectus internus, superior, inferior, and in part the obliquus inferior were paretic. On both sides the levator palpebræ and the ciliary branches remained intact throughout.

Hence we were obliged to explain the paralysis of the branches of the left oculomotorius as reflex in character. Since then the investigations of Duval and others have demonstrated the existence on the floor of the fourth ventricle of a bundle of fibres connecting the nucleus of the abducens with the nucleus of the oculomotorius of the opposite side. This connection explains why the movements of the left eye toward the right were paralyzed and the paresis of the rectus internus was the first symptom to follow the paralysis of the right abducens.

The paralysis of the facial nerve appearing immediately after the erysipelas, the pathogenetic relation of which disease to the cerebral neoplasm must remain doubtful, is explained by the close proximity of the nucleus of this nerve. The trochlearis being the nearest nerve anteriorly would then be the next nerve to be affected by the growth of the neoplasm.

Simultaneously with the paralysis of these nerves a paralysis of two nerves with associated action is observed: namely, the rectus inferior of the one and the obliquus superior of the other eye; and again of two nerves, which turn the eye in the same direction: viz., the obliquus inferior oculi dextri and the rectus superior oculi sinistri.

The distance between the nuclei of the two oculomotory nerves is small. We cannot well imagine the neoplasm invading this region without destroying a larger number of fibres in each nucleus than were actually destroyed according to the symptoms. Associated paralysis again offers a better explanation.

The existence of a common centre for the movements of both eyes to the right and to the left, effected by the abducens and the oculomotorius, was a physiological necessity, and has been demonstrated anatomically. But a similar necessity exists for a connection between the trochlearis of the one and the oculomotorius of the other side, to account for the simultaneous innervation of the obliquus superior and the rectus inferior.

Meynert has found such a connection between the two nuclei. Duval, however, believes it to be composed of commissural fibres only. Further investigations are requisite to elucidate the correctness of either statement.

The obliquus inferior oculi dextri and the rectus superior oculi sinistri also are associated in their action, turning the eyes in the supero-external and supero-internal directions. These muscles were paralyzed soon afterward, whilst the rectus inferior oculi sinistri was totally, the obliquus inferior oculi sinistri only partially, paralyzed. To explain this we must assume a partial destruction of the fibres of the left oculomotory nerve.

Further speculation regarding the origin of these paralyses would be useless, but we must yet refer to the dissociated position of the eyes observed in the later stages of the case. At this time the left extremities and the sphincters of the anus and bladder being totally paralyzed and disturbance of sensation having arisen over the distribution of the trigeminus, the right eye was drawn upward and inward

by the rectus superior dext., the left eye downward and outward by the obliquus superior sin.

In similar cases, in which this position of the eyes has been observed *intra vitam*, an affection of the inferior vermis of the cerebellum was found. In our case also this region was the seat of slight changes, due more to the mechanical influence of pressure than to pathological tissue changes, the same cause explaining the diminished sensation over the region supplied by the trigeminus.

The complicated picture, presented in this case, of multiple ocular paralysis due to intracranial disease, is not fully explained by the results of the autopsy, owing to the situation of the tumor at a point where the centres for the individual muscles are massed in a very small space.

Yet it again proves the anatomical basis for the associated action of the abducens of the one and the oculomotorius of the other side, while a similar connection between trochlearis and oculomotorius, already presumed from physiological considerations, receives considerable support through clinical observation.

III.—CYSTOID DEGENERATION OF THE RIGHT CEREBELLAR HEMISPHERE; NEURITIS OPTICA OF BOTH EYES, BUT MORE MARKED ON THE LEFT; SLIGHT DISTURBANCES OF COÖRDINATION; SUDDEN DEATH.

H. Kieler, æt. nineteen years, was admitted to the German Hospital of London, England, on September 26, 1873. He had been a steward on board of a sailing vessel, and had just returned from a prolonged voyage to Australia.

For a year before I saw him he had been troubled by severe attacks of vertigo, which often made walking, or even standing still, impossible. Both the captain and the mate on board of his vessel had often struck him on the head with the end of a rope, as a punishment for his clumsiness while waiting at the table, and to this circumstance he attributed the origin of his trouble. While yet on board ship, he often became giddy, with a tendency to turn to the left side, but he never had any convulsions or loss of consciousness. There was no history of any previous disease.

Condition on admission: Patient of slight build, and pale. There was an excess of development of his right frontal bone, which gave his face a peculiar wry and stupid expression. The supra-orbital margin of this side formed a massive protuberance. There was a slight displacement downward of the right eyeball on account of a downward protrusion of the roof of the orbit. No pain was felt, on pressure, over this region. This striking disfigurement had been present since early youth. He had never met with any injury to this particular region. The movements of the eyeballs, separate as well as associated, were normal, and the media clear. Both optic discs were of a pink color, their outlines somewhat blurred and the veins wavy. They were slightly swollen, the left more so than the right, but S was normal in both eyes.

While walking, the patient had a tendency to deviate to the left side. When standing on one or both legs, with eyes either open or closed, his body would lean over to the left side. There were no other abnormalities of motility, and his sensibility was unimpaired. His pulse, as well as his temperature, was normal.

There was no change in his general condition for the first few days after his admission to the hospital. He occasionally complained of a headache, which, however, he was unable to refer to any particular locality. He slept well. The swelling of the discs increased rapidly. The edge of the left disc, especially, became wholly obliterated by the striation of the nerve-fibres, the veins became tortuous, and the calibre of the arteries diminished considerably.

The question naturally arose, what connection, if any, there was between these symptoms and the hypertrophy of the frontal bone; but all the signs being of an indefinite nature only, not even a guess could be made as to the nature and localization of the pathological process which was undoubtedly going on within the cranial cavity.

On the afternoon of October 3, 1873, a week after his admission, the patient had a fit of nausea and vomiting, without any headache. He soon recovered from this fit, and went to sleep. After the lapse of several hours, he began to moan and to throw himself about in his bed. His pulse was fifty per minute, weak, and irregular. When spoken to in a loud voice, his attention was roused, but he gave no answer. His extremities could be moved. His breathing became stertorous, with deep inspirations. Both

pupils were dilated, and failed to respond to light. His temperature sank below the normal.

Derivatives were applied, but his breathing continued to grow worse, râles supervened, and in two hours he died comatose.

Autopsy, eleven hours *post mortem :* Scalp thick, hyperæmic, and can be readily pealed from the cranium. The right frontal eminence hypertrophied to the size of a pigeon's egg, its top rising to the height of two and a half centimetres above the level of the left eminence. Its structure is that of a compact osteosis. The rest of the skull is very thin, especially at the Pacchionian depressions, where it is no thicker than paper. There is scarcely any diploë. Owing to the abnormal development of the right frontal bone, the corresponding side of the skull-cavity is somewhat narrower than the left. The dura mater can be easily detached, and shows venous congestion.

The surface of the brain is hyperæmic. Its hemispheres are symmetrical, only the right frontal lobe is flattened corresponding to the bony growth. The cranial cavity contains from thirty to forty grammes of greenish-yellow serum. The brain can be readily removed. Its substance is firm, and does not become distended after being lifted out of the bony capsule. On inspecting the basis cerebri, the central structures situated above the pituitary body are found to be tense on account of an excess of fluid contained in the ventricles. The right cerebellar hemisphere is more prominent than the left. The choroid plexus is œdematous and bluish-red. All the ventricles are considerably dilated, most markedly the fourth. The inferior vermiform process is flattened, its structure somewhat indistinct.

The right cerebellar hemisphere contains a cyst the size of a hen's egg. Of the substance of this hemisphere, only the gray matter is left, which forms the thin wall of the cyst. Only below, where this wall is about one centimetre thick, can something of the medullary substance be found. The fluid contained in the cyst is clear, greenish-yellow, and shows no solid particles.

The size of the right orbit is less than that of the left. The position of both eyeballs is normal. The sheaths of the optic nerves are distended by serous exudation. The papillæ opticæ project like buttons into the vitreous, the left more than the right. No hemorrhages can be detected in either retina.

The right kidney shows a reticular structure like that of a calf. Both kidneys are hyperæmic.

It had evidently taken several years for the cyst of the cerebellum to form. The disturbances of coördination caused by it were mistaken for awkwardness by the patient's superiors on board of the vessel, and the blows with which they attempted to correct him were therefore the consequence, and not, as he thought, the origin, of his trouble.

According to Norris, papillitis as a rule is an early symptom in cases of cerebellar tumors. In the present case, however, it made its appearance only very late. This was perhaps due to the fact that the tumor was a cyst, and that therefore the way to the subvaginal spaces opened only after the tension in the cyst had reached its acme.

The phenomena of suffocation at the close of his life were caused by the excessive pressure exerted by the ventricular fluid upon the medulla oblongata.

IV.—GRAY ATROPHY OF BOTH OPTIC NERVES; PROGRESSIVE PARALYSIS THREE YEARS AFTERWARD; ATROPHY OF THE RIGHT OCCIPITAL LOBE.

Mr. C., a lawyer, consulted me for the first time, January 17, 1876. He had recently been unable to read small print in the evening, and wished me to prescribe proper glasses for him. He never had any trouble with his eyes before, although he had been doing considerable night-work for many years.

Mr. C. was forty-six years old, a strong and hearty-looking man, with a good family record, and had never had any serious sickness.

At every attempt at fixation his left eye deviated inward to the extent of two and a half millimetres. When tested by itself, its visual power was found to be very poor. This result of the examination greatly surprised Mr. C., who up to that time had not the slightest suspicion of any difference between his eyes. A careful test showed that some quantitative perception of light in the outer part of the visual field near to the centre was all that was left of sight in that eye.

The motility of each eyeball tried separately was found to be normal. The media were clear. Both pupils were equally narrow, dilating only a little in the dark. They contracted during accommodation as well as when light was thrown into the visual organ.

In the right eye there is manifest hyperopia $= \frac{1}{36}$. This being

corrected, S for distance is = $\frac{1}{1.2}$. With + 24 he reads Jaeger No. 1 fluently. The fundus of this eye is normal, but the left disc shows a grayish discoloration, attenuation of the arteries, and slight central cupping. The refraction, as determined with the ophthalmoscope, is hyperopic, $\frac{1}{12}$. The eye had been squinting since childhood. In the absence of any signs of a deep-seated lesion I considered the atrophy of the left optic nerve due merely to the long-continued voluntary suppression of its function. At the same time I was somewhat uneasy about the marked bilateral myosis. The patient was given convex No 24.

I next saw him fifteen months later, on April 24, 1877, when he came to me in order to have his glass changed, because the one I gave him had lately proved insufficient.

Upon examining his left eye, I found that it had become completely amaurotic, having lost even the small amount of quantitative perception of light it showed when I first examined it. The gray color of the optic nerve was more pronounced, the retinal arteries were very thin, and the excavation had extended to the margin of the disc.

The visual power of the right eye had also deteriorated. With convex No. 36, S was $\frac{1}{2}$ by good light, and only $\frac{1}{4}$ if the light was reduced. He read Jaeger No. 3. The visual field was complete, but the perceptive power in the peripheric parts seemed to be somewhat less than normal. The lower outer quadrant of the disc showed a white discoloration, but the calibre of the blood-vessels was still normal.

The diameter of both pupils had increased. They were now of medium size and contracted well during accommodation, but reacted only sluggishly to changes of light.

The fact that the right optic nerve had become implicated proved that I had been mistaken in supposing that the atrophy of the left side was due to disuse. It pointed conclusively to the presence of some intracranial lesion. No abnormality of any other function of the body, however, could be found by careful examination.

Patient was prohibited from using his eyes for any work, and active derivatives were ordered. The sudden change from a very laborious professional activity to complete idleness was met by him with a calmness of mind which was quite surprising. He carried out the prescribed treatment faithfully, and rather enjoyed his involuntary leisure time in the family and social circle.

For the next few months no change was noticed in the condition of his eyes.

During the following summer he made a trip to one of the watering-places on the coast of the German Ocean. When he returned, his eyesight was found to have greatly changed for the worse. On September 1, 1877, S of right eye for distance was $\frac{1}{3}$ with + 24, and the nasal half of the visual field was considerably narrowed. The gray discoloration of the optic disc was more marked, and the arteries were thinner. Still no general symptoms could be discovered, and the knee-phenomenon was normal. He had never complained of headache, except once or twice after bathing in the sea when high breakers had submerged him. His pupils were equally wide and contracted well during efforts of accommodation, but only very little to light.

Treatment with derivatives was renewed, and his diet regulated. Galvanism and injections of strychnia seemed to me to be contra-indicated in this case.

For the next few months his condition remained at a standstill. His disposition was all the time buoyant and hopeful.

During the following spring there was another sudden decrease of the visual power of the right eye. On April 15th, S was found to be only $\frac{1}{10}$, and the visual field was narrowed to an area situated on the temporal side of the point of fixation, and extending from this point 30° above, 20° below, and 40° to the temporal side. Color was not recognized at all. On May 10, 1878, there was complete amaurosis.

His general condition all this time remained satisfactory. He even gained flesh steadily. His judgment and his mental powers generally showed no impairment, unless the indifference at the loss of his eyesight were to be considered a pathological phenomenon. By and by he began to exhibit a morbid egotism, and from a kind and considerate husband and father became a querulous and exacting tyrant. He endeavored to conceal his helpless condition, and always was highly gratified when told that his blindness had not been noticed by his friends. He never wavered in his hope of regaining his eyesight, and would often claim to be able to discern the passing clouds upon the sky while his eyes were directed toward the wall of the room opposite the window. He became very intolerant of contradiction, his excitement betraying itself by convulsive twitchings of both sides of his face. After a further lapse of several months he developed

extravagant notions about the extent of his means. He ordered ridiculous quantities of provisions, wine, and fancy articles, bought numerous gold rings for himself; and when he found that his wife opposed his lavishness he tried to induce the servants to write orders for goods without her knowledge. When asked, he always said that he felt exceedingly well. He was fond of company and of dinners, though his sense of taste was so much blunted that he could not distinguish wine from water. This did not prevent him, however, from praising indiscriminately every thing that was placed before him.

Both optic discs had a pronounced gray color, and were deeply excavated. The arteries were hardly discernible. Nystagmus now set in, the movements of the eyeballs being partly vibratory, and partly rotatory. The patient saw the most beautiful phosphènes; he only regretted that they changed so rapidly.

His *manie de grandeur* increased continually, and he became subject to erotic spells. He masturbated frequently, each act being followed by a condition of excitement lasting for hours. He ceased to show the slightest concern about his wife and children.

His sphincter muscles now becoming involved, though there was no other defect of motility, he was removed to the institution of Dr. Oebeke, in Endenich.

One morning, after having been there only a short time, he was suddenly taken with convulsions and loss of consciousness, and died before the physician in charge arrived.

Autopsy twenty-five hours after death: Bones of the skull thick, with little diploë. Left side of cranial cavity larger than right. Dura mater adherent to skull. A large quantity of bloody serum in the arachnoid space. Pia mater can be detached only with difficulty, and is firmly adherent in the region of the left frontal lobe. This lobe is somewhat narrower than that of the right side. The right occipital lobe is shorter than normal, leaving part of the cerebellum uncovered. Left frontal and parietal lobes flattened. The substance of the cerebrum œdematous very soft. Both olfactory bulbs wider than normal. Optic nerves, chiasm, and tracts smooth, thin, grayish, and translucent. Cerebellum not quite so soft as cerebrum. Weight of brain including soft membranes 1,255 grammes.

In the foregoing case the following points are of interest:

(1) The early and simultaneous appearance of myosis in both eyes. (2) Atrophy of the left optic nerve was complete long before there was any implication of the right side. (3) Total amaurosis of both eyes remained for some length of time the only symptom of cerebral disease. (4) The atrophic condition of the right occipital lobe discovered at the autopsy.

This case showed the same symptoms which Vincent[1] describes as occurring in progressive paralysis. Among twenty-one cases of this affection recorded by him, in which useful sight was preserved, the reaction of the pupils to light and upon accommodative efforts was normal in three cases. In eleven cases the pupils contracted well during accommodation, but were only slightly affected by the stimulus of light. In the remaining number the reaction to light was completely abolished, whilst accommodative contraction remained normal.

The degree of hypermetropia of both eyes had probably been higher in youth than at the time of the first examination. This error of refraction had led to squinting and to the exclusion of the left eye from the act of vision. It would be difficult to decide whether the atrophy of the nerve of this side should be regarded as the consequence of this circumstance, or whether it was the first symptom of progressive paralysis.

There was doubtless a causative relation between the atrophic degeneration of the left optic nerve and that of the right occipital lobe, both having evidently taken a long time to develop.

The occurrence of complete amaurosis long before the development of any other symptom, in cases of general paralysis, has been described before by Westphal,[2] Wendt,[3] and Wolff, whilst Albutt[4] speaks of ophthalmoscopic changes as occurring only toward the end of the first stage of the disease.

[1] Des phénomènes oculo-pupillaires dans l'ataxie locomotrice progressive et la paralysie générale des aliénés. *Thèse de Paris*, 1877, p. 69.

[2] *Archiv für Psychiatrie*, Bd. i, p. 44.

[3] *Zeitschrift für Psychiatrie.*

[4] "On the Use of the Ophthalmoscope in Diseases of the Nervous System." 1877.

Unfortunately no microscopic examination of the brain has been made in this case. It would be especially interesting to know how far the atrophic degeneration of the cortical substance of the right occipital lobe had progressed, on account of the absence of hemiopic symptoms in the right eye.

According to Huschke[1] the normal weight of the brain between forty and forty-nine years is 1,406 grammes. In our case it was only 1,255, the difference being evidently due to atrophy of the right cerebral hemisphere.

[1] Schädel, "Hirn und Seele." Jena, 1854, p. 60.

OCULAR LESIONS AFTER INJURIES OF THE BRAIN AND SPINAL MARROW.

By Dr. A. NIEDEN, of Bochum, Germany.

(*With two wood-cuts.*)

Translated by Dr. A. Schapringer, New York.

I.—FRACTURE OF THE BASE OF THE SKULL; AMAUROSIS OF THE LEFT EYE; TEMPORAL HEMIANOPSIA AND PARALYSIS OF THE EXTERNAL RECTUS MUSCLE OF THE RIGHT EYE; SUPPOSED PARTIAL RUPTURE OF THE CHIASMA.

Mr. Weustermann, a miner, æt. 28 years, was brought to my clinique August 29, 1881. The day previous, while working in the mine at the top of a steep ascent sixty metres high, he was struck on the left temple by a large rock which had become detached from the roof of the mine, and fell head-foremost the whole length of the declivity. He was picked up unconscious, bleeding profusely from the mouth, nose, and ears. During the night he vomited several times, and his breathing being stertorous, his friends expected him to die every moment. He survived, however, and even consciousness returned a short time before his admission. When spoken to in a loud voice, he gave short answers slowly but correctly, without, however, realizing where he was or what had happened to him, nor did he at first recognize his acquaintances. He complained of intense pain all over his head, and of continuous nausea. When not spoken to he would fall into a broken doze, moaning and muttering a great deal, and often touching his head with his hands.

The patient was a tall and powerfully built man. The left side of his face, which had been struck by the rock, showed extensive ecchymoses. The eyelids of this side were so much swollen that it was impossible to separate them in order to examine the eyeball.

The skin was abraded. No fracture of the skull could be detected by palpation, but percussion of the head gave the patient great pain. Both external auditory canals, as well as the nares, were filled with coagulated blood, on the removal of which the drum-heads were found to be intact, the patient still remaining hard of hearing and complaining of a roaring noise in his head, especially on the right side.

The right eyeball was found to be turned inward, owing to paralysis of the external rectus muscle. The background of the eye was normal. Approximate functional examination revealed central V to be perfect. On account of the drowsy condition of the patient the field of vision could not be determined. The reaction of the pupil was normal.

There was no disturbance of motility or sensibility of either trunk or extremities. The sphincters of the rectum and the bladder were not paralyzed. Temp., 38.2° Centigr.; pulse, 50 to 52.

The diagnosis of fracture of the base of the skull and paralysis of the right external rectus muscle was made. Ordered: Absolute rest and antiphlogistic treatment.

In the evening of the day of admission the temperature rose to 38.8° Centigr. Patient continued drowsy, answering, however, questions put to him in a loud voice. There was no recurrence of vomiting, but he moaned a great deal, and complained of intense headache and great thirst. From the moment of his admission polyuria was a marked symptom. During the first twenty-four hours he voided more than 6,000 Cc. of urine, the quantity of liquids taken during the same time being considerably less. The urine was clear, light-colored, devoid of smell, of a specific gravity of 1,002 or 1,003 and did not contain either sugar or albumen.

On the following day he was more conscious. He slept most of the time, but woke up almost every hour and asked for drink. Headache was less marked, and the swelling of the soft parts was subsiding.

On the third day the temperature was normal and remained so. The pulse was strong, but continued to be less frequent than normal. The quantity of urine secreted during twenty-four hours varied between 6,000 and 6,400 Cc., corresponding to the quantity of liquids imbibed; its composition remained the same.

For five days it was impossible to separate the lids of the left eye sufficiently to examine the condition of the globe. Then the

conjunctiva was found to be greatly swollen. The eyeball itself appeared to be uninjured and possessed of normal mobility. On testing the sight, it was found to be entirely abolished, there being no perception of light in any part of the visual field. On examination with the ophthalmoscope no changes were visible which could account for the total abolition of sight.

A few days later the visual field of the right eye was tested, and the temporal half discovered to be wanting, the nasal half only being preserved with normal S and color-perception. The line of demarcation, as shown in the diagram, passed through the

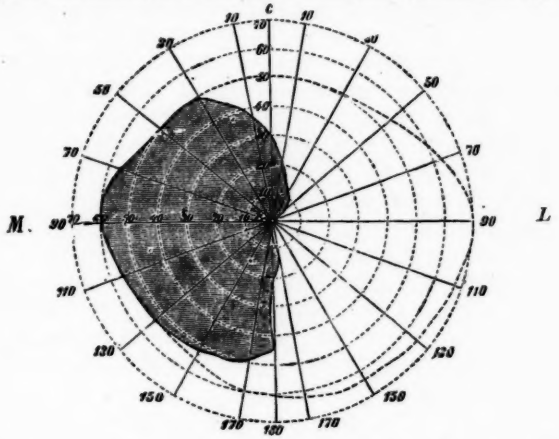

FIG. 1. RIGHT EYE.

The shaded part shows the extent of the field of vision preserved, the dotted line indicating the extent of the normal field of vision.

point of fixation, deviating a little from the vertical line both above and below. The inconvenience caused by the absence of the temporal half of the visual field was aggravated by the paralysis of the external rectus muscle of the same eye, which paralysis abolished the temporal part of the field of fixation. The patient endeavored to overcome to some extent the combination of these defects by habitually bending his head toward his right shoulder.

His general condition improved. Thirst and polyuria continued for a week, and were not influenced by large doses of opium, which were otherwise well borne. Headache and drowsiness decreased, the intellect became quite clear, but the patient still

could not remember any thing connected with his accident.

The swelling of the left side of the face and the chemosis having gradually subsided, the eye at last could be freely opened. The pupil was of normal size, and contracted promptly during efforts at convergence and whenever light was thrown into the right eye.

Patient still complained of a roaring noise in his head, especially on the right side. When in an erect position he suffered from intense pain along the course of the right sciatic nerve. In walking he dragged his right leg, like one whose extensor muscles are paralyzed. Both innervation and contractility of the muscles proving to be unimpaired, the patient's limping was evidently due to the pain in the limb only. The sensibility of the skin was normal and equal on both sides of the body. The patellar and Achilles tendon reflexes were also normal. The pain in the right lower extremity was caused by hyperæsthesia and neuralgia of the sciatic nerve, which was aggravated by motion, but annoyed the patient even at times when he kept quiet.

The galvanic current was used without bringing any relief. The reaction of the muscles to its application, as well as to that of the faradic current, was normal.

During the next few days the pain increased so much that the patient could not leave his bed, and hypodermic injections of morphia had to be used freely. It was thought that, at the time of the accident, the sciatic nerve had possibly been bruised. A close inspection of the parts, however, did not corroborate this supposition. The patient was then put on antirheumatic remedies—such as soda salicylate and iodide of potassium, but with a negative result. After the lapse of another week the pain began to subside, and from that time his general condition continued to be satisfactory. The quantity of urine decreased to 5,000 Cc. per day, its chemical composition remaining unchanged.

The amaurotic condition of the left eye persisted. Efforts at fixation with the right eye caused the left eye to make rapid oscillating movements about its vertical axis.

The power of hearing on the right side was completely abolished and remained so subsequently ; on the left side it was found slightly diminished. The headache ceased entirely. The thirst abated somewhat under the influence of electricity, which was now being applied through the head. The urine continued to decrease to about 4,000 Cc. His mind was quite clear, but he seemed to be somewhat slow of perception. It always took him some time

before he would answer a question, but the answers were always correct, and he never made use of a wrong word. He complained of his memory being weak, and especially that he could not remember the circumstances of his accident.

Six weeks after his admission the first signs of beginning atrophic degeneration of the left optic nerve exhibited themselves. The inner half of the disc became white, and the arteries showed a diminished calibre. There was no change visible in the interior of the right eye. Its field of vision was examined repeatedly, and always with the same result, with the exception of very slight deviations of the line dividing the preserved from the missing portion.

The urine decreased to 3,500 Cc ; the thirst was very moderate, the general condition satisfactory. He was discharged October 16, 1881.

The atrophic process of the left optic nerve progressed. Ten weeks after the accident the inner upper quadrant of the right optic disc began to show white discoloration, but the calibre of the vessels did not diminish. The external rectus muscle began to regain its power without any treatment whatever, and in the month of December the eyeball could be rotated outward far beyond the middle line. Consequently he did not turn his head toward the right shoulder as much as before. There was little thirst, and the quantity of urine varied between 2,000 and 2,500 Cc. The function of the right ear remained completely abolished, that of the left ear was only impaired by the tinnitus.

Six months after the accident had happened the patient had regained his usual weight and seemed in good health, but still complained of his eyesight. The left eye was still amaurotic, with marked atrophy of the optic nerve. Efforts at convergence caused oscillating movements of the eyeball, the pupil, however, contracting well. The field of vision of the right eye was the same as before. The paralysis of the right external muscle completely disappeared, but the patient persisted, nevertheless, in the habit of bending his head toward the right shoulder on account of the absence of the temporal half of the visual field. He did not complain of thirst any longer. The quantity of urine varied between 1,500 and 1,800 Cc. Its color was darker, and its specific gravity 1,008. He worked at his trade again though not steadily.

Epicritical Remarks.

If we take into consideration the nature of the injury, the hemorrhage from both ears, the complete loss of hearing on one side, and the grave cerebral symptoms which followed, the diagnosis of fracture of the base of the skull appears to be established beyond any doubt.

The total abolition of sight in the left eye, and the temporal hemianopsia of the right could have been caused by a lesion of the optic tracts, or the chiasma, or the optic nerves. The lesion was evidently of such a character as to lead to the complete destruction of the nerve-fibres, causing the atrophy shown by the ophthalmoscope.

It would seem improbable that the left optic tract in its entirety, and *exactly one half* of the right tract, should have been severed.

Another supposition would be that the left optic nerve and the inner half of the right nerve were implicated in the destructive lesion, but this hypothesis also seems to me to be untenable. In either case, if the lesion had been in front of or behind the chiasma, other parts besides the right abducens nerve would have necessarily been implicated.

The only way to explain the disturbances of vision is to assume that the chiasma itself was the seat of a lesion, all the fibres composing it being severed with the exception of the right lateral fascicle.

The visual phenomena might further be explained by pressure upon the chiasma of blood extravasated in the third ventricle and in the recessus. The blood passing through the aquæductus Sylvii into the fourth ventricle would there affect the nucleus of the right abducens nerve as well as the centre of diabetes. There is, however, this objection against such a theory, that it would not explain why only three fascicles of the chiasma, viz., the fasciculus cruciatus and lateralis of the left side and the fasciculus cruciatus of the right side, should be affected, and the right fasciculus lateralis escape. Besides, mere compression would hardly cause the complete and permanent loss of function observed in our case. If the paralysis of the right abducens nerve

had been caused by compression of its origin in the floor of the fourth ventricle, the nuclei of the fifth and seventh nerves would not have escaped implication. It is more simple to bring the lesion of this nerve in connection with the abolition of the hearing power of the same side, and to explain both by a fissure extending from the middle of the sphenoid into the petrous portion of the right temporal bone, implicating that part of the abducens nerve of the same side which passes through the cavernous sinus.

It is by no means necessary to assume a lesion of the floor of the fourth ventricle to explain the diabetes, since there are on record many cases of diabetes occurring as a brain symptom, where the fourth ventricle was found free from disease. For instance, in the case published by Dreschfeld (*Centralblatt für Augenheilkunde*, vol. iii, p. 33), the following symptoms were observed during life: amaurosis of the right eye, complete temporal hemianopsia of the left eye, central S of left eye = 1, diabetes insipidus, paralysis of the right oculomotor, abducens, and trochlearis nerves. At the autopsy the right side of the chiasma was found to be converted into carcinoma, but the floor of the fourth ventricle was entirely intact.

Wilbrand[1] has collected 76 cases of hemianopsia with and without autopsies. In five of these cases diabetes insipidus was present. In three of the latter a tumor was found situated in the posterior angle of the chiasm, and in the other two on its side. It is known that tumors situated between the posterior angle of the chiasm and the pons are often accompanied by diabetes. Besides the five cases of diabetes insipidus, there were three cases of diabetes mellitus; altogether diabetes was present in eight cases or 10.5 per cent.

While the proof-sheets of this case were passing through my hands, I met with another case of injury to the skull, which presented symptoms so similar to the one just narrated that I take the liberty to append a short account of it.

Mr. Stein, a miner, æt. twenty-five, was struck on his head by a heavy piece of coal falling on him on May 23, 1882. There was

[1] "Über Hemianopsie und ihr Verhältniss zur topischen Diagnose der Gehirnkrankheiten. Berlin, 1881, p. 88.

a wound of the scalp extending in a horizontal direction across the entire width of the occipital bone; also fracture of the right forearm, dislocation of the right thigh-bone, and all the symptoms of fracture at the base of the skull. The patient recovered, and was presented to me August 1, 1882. I found complete amaurosis of the right eye. The pupil of this eye was of medium size, and contracted when the eyes converged, or when light was thrown into the other eye. The eyeball made oscillating movements during efforts at fixation. On the left side there was complete paralysis of the external rectus muscle; S = $\frac{1}{4}$. The field of vision was narrowed concentrically. In the temporal half of the field there was only slight perception of light between the vertical line passing through the point of fixation to a line situated 32° to the outer side of it. In the nasal part of the field the white square was recognized up to 45°. Normal S and color-perception were preserved only in a small part extending about 15° in a downward and inward direction from the point of fixation. With the ophthalmoscope the right optic disc was found completely atrophied, but the left was normal in all respects. The hearing of the left ear was gone. Besides this there was no other disturbance either of sensibility or motility. There had been great thirst in the first few weeks after the accident, but the urine had not been examined.

The analogies of the two cases are obvious. There is almost no difference, except that the lesions have changed sides. The conclusion is forced on us, that the nature of the lesion at the base of the brain in this case was similar to that in the one first detailed. The destruction of the chiasm, however, must have been greater in the latter patient because the field of vision left was much smaller.

II.—PERFORATING WOUND OF THE LEFT TEMPORAL BONE; PARALYSIS OF THE LEFT ABDUCENS NERVE; RIGHT-SIDED HEMIPLEGIA WITHOUT LOSS OF SENSIBILITY; SENSORY APHASIA.

Mr. Pothoff, a miner, æt. twenty-four, consulted me on Jan. 15, 1882, for a squint of his left eye.

On October 30, 1881, he had been attacked by roughs and stabbed in the left temple with a jack-knife. He fell to the

ground unconscious and was picked up a few hours later. Next to him, in a large pool of blood, lay the knife with which he had been injured, its point unbroken.

He was seen by a physician, who found him unconscious and with stertorous respiration. Midway between the left superciliary arch and the auricle of the same side there was a wound running in a vertical direction for about 3 *cm.*, with clean-cut edges. A line drawn from the top of the superciliary arch to the tip of the auricle would divide the wound into two unequal parts, the upper one being the larger. The edges were glued together. Examination with the probe revealed the fact that the squamous portion of the temporal bone had been penetrated, but the probe could not be passed through the fissure of the bone. The patient kept his eyes closed spasmodically, not reacting when spoken to, but moaning occasionally, and putting his left hand to his head as if suffering pain there. There was no involuntary discharge from the bowels or the bladder. The wound having been cleaned and stitched together, ice was ordered to be applied to his head.

After some hours he would mutter a few incoherent words, apparently whenever he had a paroxysm of pain or when he desired to urinate. Neither the tongue nor the muscles of the face were affected in any way, but it soon became apparent that he had lost the power of using the lower as well as the upper extremity of the right side; the sensibility of which parts, however, was preserved.

Later on the patient opened his eyes when spoken to, though only to stare about wildly without recognizing anybody. His answers were incoherent, though the pronunciation of the words was correct. At this time it was noticed that he would use the same words to express entirely different things, as, for instance, when he desired to micturate and when he wanted some water to drink. Mastication, deglutition, and defecation were normal. Most of the time he was in a state of stupor, occasionally muttering unintelligibly.

The wound healed *per primam* within three days. He ceased to moan, but the paralysis of the right side remained. When he finally opened his eyes the left was found to deviate strongly toward the nasal side. His consciousness not having yet returned, it was not possible to accurately examine the function of the ocular muscles, but by turning his head to one side and attracting his attention from the other, it could be made out beyond doubt that

the left external rectus muscle was completely paralyzed. The pupil of this eye reacted normally.

Consciousness did not return until the end of the third week, when he began to answer questions slowly and hesitatingly, often using wrong words. His memory was very deficient, especially regarding the circumstances of his accident. The headache decreased. While he regained the use of some of the muscles of the lower extremity slowly, the arm remained limp and useless. The left eye could not be moved outward beyond the middle line. He kept this eye closed most of the time, and did not complain of double images. A superficial examination of S was made and it was found to be normal. The appetite and the general condition of the patient were satisfactory.

On Dec. 8th he left his bed. The right leg improved rapidly, and in the course of a week he was able to walk about unaided. Under treatment with the electric current, which produced violent contractions in the muscles of both the upper and lower extremities, his right arm also began to improve, whilst the paralytic squint of the left eye remained stationary. His ideas began to form more rapidly, and he had less difficulty in finding the proper words to express them. He slept well. After the lapse of another four weeks the use of his right arm and leg was restored, and he came to consult me about his squinting left eye.

I found complete paralysis of the left external rectus ; S = 1. By the use of colored glasses double images could be produced in the ordinary way. The fundus of both eyes was normal. The acts of ideation and volition were retarded. There was loss of memory for recent events, and occasionally also for certain words. There was still some paresis of the muscles of his right upper extremity, and some stiffness in several of its joints. He dragged the right leg slightly, and it inconvenienced him somewhat when he attempted to turn his body rapidly. The sensibilityof the extremities of the right side and the patellar reflex were normal. So were also the facial muscles. The movements of the tongue and deglutition were perfectly free. The cicatrix over the left temple was adherent to the bone, not sensitive to pressure. Percussion of the skull was not painful. Patient kept his left eye closed most of the time, had no vertigo, and was able to do light work. The condition of the left eye did not change.

It would seem rational to advance the external rectus muscle of this eye in order to diminish the deviation.

Epicritical Remarks.

In this case there was a direct injury of the skull and the brain in the region of the left temporal lobe. The knife with which the injury had been inflicted perforated the upper part of the squamous portion, and was withdrawn with its point uninjured. From this we can infer that the blade did not enter the skull cavity to any depth, and that the opening in the bone was considerably smaller than the external wound, which must have been enlarged by to-and-fro movements of the knife while it was being withdrawn. The sudden unconsciousness which could only be produced by compression of this part of the cerebrum, might be explained by hemorrhage from one of the meningeal vessels running over the inner surface of the squamous portion of the temporal bone.

The absence of paralysis of the tongue, face, and pharynx, and the preservation of the sensibility of the paralyzed extremities, however, militate against the assumption of an extravasation in the region named. The complex of symptoms exhibited by the patient points rather to a direct injury of that part of the cortex comprising the *gyri centrales* and the paracentral lobule, which region is known to be the motor centre of the extremities. In order to produce such

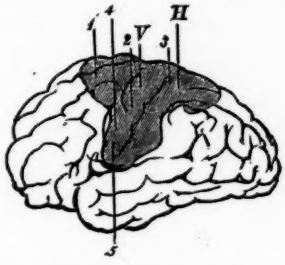

FIG. 2. (AFTER ECKER.)

H — Posterior Central Convolution.
V — Anterior " "
1 — Centre of Oculomotor Nerve.
2 — " " Upper Extremity.
3 — " " Lower "
4 — " " Facial Nerve.
5 — " " Hypoglossal Nerve.
The dark portion represents the Motor Area.

a lesion, the direction of the knife must have been from below upward, its point glancing along the inner aspect of the squamous portion for some distance before touching the cortex. This hypothesis is corroborated by the temporary loss of word-memory, the centre of which is generally supposed to be located in the posterior part of the third frontal convolution. No centre has as yet been found in the cortical substance for the abducens nerve, by clinical or experimental investigation, though centres have already been found for the oculomotor, the facial, and the hypoglossal nerves. The paralysis of the sixth nerve in our case must, therefore, remain unexplained for the present. There is every reason to expect that a cortical centre for this nerve will soon be discovered in the region of the motor area.

According to Nothnagel,[1] paralysis of the extremities of one side, associated with paralysis of the abducens nerve of the other side, has been observed in connection with lesions of the lower part of the pons, near the medulla oblongata, but in this case an implication of that locality could not be thought of.

III.—CONCUSSION OF THE BRAIN AND SPINAL MARROW; SLIGHT INITIAL SYMPTOMS, FOLLOWED BY PROGRESSIVE SPINAL ATAXIA, EXOPHTHALMUS OF BOTH EYES, AND ATROPHY OF BOTH OPTIC NERVES; SLOW IMPROVEMENT OF GENERAL CONDITION.

Mr. Strathmann, aged nineteen years, was one of a party of six miners, who were being lowered down the shaft of a mine, Jan. 2, 1878, when, owing to some mistake of the engineer, the car was hurled to the bottom of the shaft, and its occupants thrown violently against each other and against the walls of the car. Blood oozed from mouth and nostrils, and he fell unconscious. He was brought to the surface, where the oozing soon stopped, but his whole face became considerably swollen. With the exception of a slight laceration in the region of the left knee, no external injury was visible. He soon recovered consciousness, and in spite of aching pains in his limbs was able to walk home unaided. In a few days, during which he kept

[1] "Topische Diagnostik der Gehirnkrankheiten." Berlin, 1879, page 551.

himself quiet, his general condition improved. The swelling of his face decreased, the wound of his knee healed, and at the end of three weeks he was able to resume light work ; but he could not bend his head strongly either forward or backward without experiencing pain in his occiput, vertigo, and nausea. This symptom grew worse slowly, and soon he would become so dizzy with every sudden motion of his head forward or to the side, that he had to grasp the nearest object in order to save himself from falling. The nausea accompanying the vertigo increased. When vomiting occurred he felt relieved, and could soon resume work. Retaining an erect posture for some length of time produced a growing sense of weakness in his back, with occipital headache and nausea, which symptoms disappeared when he lay down.

In this condition he remained for about nine months. In the month of September, 1878, the pain in the occiput became more violent and recurred more frequently, finally leaving him only while he lay in bed. About this time he began to be annoyed by alternating spells of heat and cold, which seemed to originate in his back, travelling thence through his chest to his limbs. These spells were not accompanied by any unusual amount of perspiration.

The feeling of weakness in the back during erect posture continued to increase. The slightest jarring of his body, even that produced by quiet, slow walking, caused disagreeable sensations in his head. He usually held his head backward.

During the month of September he noticed that the sight of his right eye began to fail. His physician, to whom he presented himself again, for the first time after a lapse of eight months, now noticed that both his eyes protruded from their sockets, and sent him to me.

When I saw him on the 18th of Dec., 1878, he was not able to walk without assistance. The motions of his legs were jerky, like those of persons suffering from locomotor ataxia. If he attempted to stand alone, his knees would give way immediately, and he sank to the floor. Owing to the protrusion of the eyeballs, which was moderate in degree and equal on both sides, the expression of his wan and sallow face was peculiar. His upper lids, which he moved very infrequently, lagged behind when he looked downward, leaving a considerable portion of the sclera exposed. There was considerable lachrymation. The motility of both eye-

balls and pupils was normal, and the bulbi could easily be pressed back to their normal position. Even slight exertion caused profuse perspiration on his forehead, while his whole face became bloated. He had intense pain in his occiput, and nausea whenever he attempted to stand up or walk, and actually vomited when he persisted in the attempt. His head was bent backward, his spinal column remarkably straight, the normal curvatures being almost obliterated, and he was rather sensitive to strong pressure exerted anywhere along its course, but there were no special painful spots. Even if held on both sides, he could hardly stand up with his eyes closed.

While in the recumbent posture, he could move his legs freely. The patellar reflex was entirely abolished on the right side, and nearly so on the left. The sensibility of the skin of the chest and the extremities was normal. Headache, vertigo, and nausea supervened even in the recumbent posture, whenever the head was raised to a higher level than the body. These unpleasant symptoms disappeared promptly when the head was lowered. The functions of the intestines were undisturbed. He had occasional spells of dyspnœa, accompanied by increased frequency and shallowness of respiration, and accelerated pulse. There was no goitre, and the heart-sounds were normal.

The visual acuteness of the right eye was $\frac{1}{10}$, that of the left $\frac{1}{2}$. The ophthalmoscope revealed white discoloration of the inner half of the right optic disc and attenuation of the arteries. The vessels of the left optic disc were of a normal calibre, but the lower inner quadrant began also to show white discoloration. In the right eye a great portion of the outer half of the field of vision was wanting, while in the left the area of the upper outer quadrant was narrowed.

The treatment instituted consisted of the galvanic current along the spinal marrow, and rest in bed. The dyspnœa was controlled by bromide of potassium.

About the middle of January, 1879, he was able to sit up in his bed for some time without a recurrence of either headache or vertigo. The exophthalmus as well as the amblyopia remained stationary. The condition of the pupils continued to be normal. He could read for a short time, the accommodative power of his left eye soon giving out.

His general condition continued to improve during the course of the next few months. He never complained of a sense of con-

striction around his body (*Gürtelgefühl*). He began to walk about the room, staggering, however, considerably.

In the course of the summer, 1880, I again examined his right eye, the sight of which had been growing worse, and found the atrophic changes of the disc more marked than before; posterior polar cataract, S = $\frac{1}{20}$, slight divergent strabismus, exophthalmus somewhat less. In the left eye the condition of the fundus, of S, and of the visual field had not changed.

The symptoms of incoördination were more marked in the right leg than in the left, just as the disturbances of vision were more prominent in the right eye than in the other. With his eyes open the patient could balance himself for a few seconds on his left leg, but not for a single moment on his right. The sensibility of the skin, the motility of the face and of the upper extremities, were normal and equal on both sides of the body. He still carried his head well backward, and his spine, over which there were no painful spots, stretched in a straight line, and suffered less often from headache and vertigo.

In the month of May, 1881, he had so far recovered that he could walk from his residence to my office, a distance which ordinarily takes three quarters of an hour to walk. He became considerably exhausted, however, his right leg trembling violently and making a jerk every time it was put forward. The exertion also made his eyes more prominent than usual, but otherwise the exophthalmus had not increased of late. The upper lids moved more freely than before, following the eyeballs when these were rotated downward. The peripheric zone of the right visual field had become uniformly contracted, and therefore the general outline of the fields less irregular, and the defects of the outer upper and lower quadrants less noticeable. The atrophic condition of the nerve, as well as the posterior polar cataract, was found *in statu quo*; S was still = $\frac{1}{20}$. In the left, S was = $\frac{1}{2}$ as before, though the white discoloration of the disc had increased, the calibre of the vessels, however, having remained the same. The temporal part of the visual field had been decreased by several degrees. When he attempted to look at an object steadily, the eyeballs made rotatory movements, as in nystagmus. These nystagmus-like motions were more feeble and less rapid when the point of fixation lay to the right than when it lay to the left of the median plane. When he looked into space, the right eye deviated a few millimetres to the temporal side. The condition of the pupils was

normal. The power of accommodation of the left eye had improved considerably, so that he was able to read fine print for quite a time without fatigue. His digestion was good, his mind so clear that he was able to write a history of his case. His occipital headache troubled him only when he coughed or sneezed. The dizziness had left him entirely. The ataxia of the legs had remained, but the difference of the two sides had become less noticeable. There was no loss of sensibility anywhere.

Epicritical Remarks.

This was a case of severe concussion of the whole length of the spinal column and its contents. The hemorrhage from the nostrils and mouth and the swelling of the face were evidently not connected with the main injury, and their significance was unimportant. The man, returning to his usual occupation, was able to follow it for months before he was forced to stop by a general feeling of weakness, aching in his limbs, especially the lower extremities, inability to maintain the erect position for any length of time, and violent occipital pains with periodical exacerbations. These were followed by a complex of symptoms resembling locomotor ataxia. All these phenomena are explained by a molecular disturbance of the nervous elements of the spinal marrow caused by concussion; this disturbance being greater on the right side than on the left, as the subsequent preponderance of the symptoms on that side showed. The sensitiveness of the spinal column to pressure, and the peculiar way in which the patient stretched it to a straight line, and bent his head while he walked, point to a general distortion of all the articulations in the vertebral column. The slow development of the case and the absence of febrile disturbance exclude the possibility of inflammatory changes.

The experiments of Rieger and Von Forster[1] prove that irritation of the spinal marrow is followed by dilatation of the retrobulbar as well as of the intra-ocular vessels, which fact explains the exophthalmus in our case as well as the changes of the optic nerves. The patient's eyes not

[1] *Graefe's Archiv f. Ophth.*, Bd. xxvii, 3, p. 109.

having been examined until a long time after the accident, I do not know whether the atrophy of the discs was preceded by a hyperæmic stage or not, but it very probably was. This supposition is corroborated by the history of other symptoms of vaso-motor disturbance, such as excessive perspiration, palpitation of the heart, and vertigo, which was evidently due to hyperæmia of the brain.

The favorable progress of the case generally indicates that no destructive process was going on in the elements of any of the nerves affected, with the exception of the optic nerves.

A CASE OF ECTOPIA OF THE EYEBALL BY OSTEOPHYTES FROM THE ROOF OF THE ORBIT, WITH CONSECUTIVE PNEUMATOSIS OF THE SUPRA-ORBITAL REGION.

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(*See figs.* 1–5, *plates vii and viii.*)

Translated by Dr. J. H. Shorter, of New York.

I HAD an opportunity to observe a patient, and to operate on him with success, whose right eyeball was displaced down and outward from its normal position by osteophytes growing from the upper wall of the orbit as a sequence of disease of the frontal sinus, under which, later, through absorption of the walls of the frontal sinus, an emphysematous tumor appeared in the region of the eyebrow.

In the literature which is accessible to me I have not found a similar case, therefore I regard a full description of this one as indicated, and in the following will give the history of the disease and operation, and the result of the microscopic examination of the growths removed in the operation, on which is grounded the diagnosis.

A. Farching, seventeen years old, candidate for professorship, had, according to statement of his mother, suffered with hydrocephalus, which was confirmed by shape of the skull. He learned to walk at twenty months of age. Otherwise he had not experienced any severe illness. He had always enjoyed good sight.

During the latter months before he presented himself the patient suffered frequently with a dull frontal headache ; but the

forehead and supra-orbital border were never sensitive on pressure; and, as he stated, there had never been any thing peculiar to remark in or about the right eye.

The protrusion of the right eyeball was first noticed by his colleagues.

When patient presented himself, 12th April, 1881, I noticed the following condition :

The right globe protruded. The difference in apices of the corneas amounted to about 5 *mm.* Nothing abnormal to be observed in lids, conjunctivæ, or external parts of visual organs. The excursion of the right eye was as free as that of the left. V = $\frac{6}{6}$, H = $\frac{1}{14}$, in each eye. This refraction was verified by ophthalmoscope.

The visual field, both in peripheral extent and in area, was on both sides normal as well for colors as for white. The ophthalmoscope showed clear media and normal fundus.

Beyond this I noticed nothing in examination of the patient, excepting the marked rachitic shape of upper and lower incisors, and the hydrocephalic form of the skull.

I restricted myself at first to recommend to the patient to drink the iodine waters of Halle.

On 7th September saw him again. At first superficial view the exophthalmus seemed to have subsided. A comparison, however, of the position of the corneal apices, measured over root of nose, showed that it remained about in its former degree, and that the impression that the globe again occupied its normal position in the orbit was produced by a thickening of the upper border of the right orbit which had taken place especially about the middle part.

This thickening prevented the sharp edge of the roof of the orbit from being as distinctly felt on right side as on left. On pressure, neither this place nor its neighborhood was sensitive ; the skin overlying it was entirely normal and freely movable. Functional examination and ophthalmoscopic condition about as in April.

October 12th.—The upper border of right orbit generally thickened and rounded off. In the region of the notch can be felt a sharp-edged, boat-shaped depression, about 2 *cm.* long. The globe showed, in addition to the exophthalmus, which remained about the same, a noticeable displacement downward. R. E., M = $\frac{1}{60}$; L. E., H = $\frac{1}{14}$. V = $\frac{6}{6}$, both eyes. Ophthalmoscopic

condition normal. Restriction in movement of right eye not demonstrable. No diplopia.

November 18*th.*—The sharp-edged excavation noticed in the thickened edge of the upper border of right orbit has reached a length of 3 *cm.* It ends laterally, about where the ext. angular process of the frontal bone goes over to the malar bone. Its posterior boundary is no longer to be felt; seems to have disappeared into the roof of the orbit. Six *mm.* from the lateral end of the above depression, inward and upward, a small hard ridge-shaped body can be felt on its sharp edge projecting downward, which seems a growth from the anterior surface of the frontal bone. The outward movement of right eye a little restricted.

January 4, 1882.—The little ridge-shaped projection has increased 4 *mm.* in length; inward from it a similar elevation can be felt perceptibly. The exophthalmus remains unchanged. The downward displacement of eyeball has increased. Excessive lateral movements of globe are painful.

February 12, 1882.—Patient states that two days before, while sneezing forcibly, a swelling suddenly appeared under the right eyebrow, which disappeared during the night following. He experienced no pain from it. On making the patient expire strongly with mouth and nose closed, a small flat, spindle-shaped swelling appears under the edge of the eyebrow. This swelling presents a smooth surface and distinct boundaries, feels elastic, and the skin can be raised in folds over it.

By pressure and rubbing the swelling can be made to almost entirely disappear. It is then perceived that the ridge-like projections of bone mentioned before have increased in length downward. They present now the feeling of plugs about 3 *mm.* wide, which with their rounded-off ends are only distant 1½ *mm.* from the globe. Inspection of upper fornix conjunctivæ shows no projection. The percussion sound from the swelling and the supra-orbital region is tympanitic. $V = \frac{6}{6}$ both sides. R. E., $M = \frac{1}{40}$; L. E., $H = \frac{1}{24}$. The tension of right eye seems perceptibly increased. Field and ophthalmoscopic condition normal. On looking strongly to right there are homonymous double images. The swelling can be produced at will by the beforementioned manœuvre; by so doing, the right eye is moved 2 to 3 *mm.* downward.

February, 14*th.*—The swelling can still be always produced by forced, impeded respiration. It reaches somewhat farther in-

ward, and has greater width. On its being pushed away, the hard bony pegs can be distinctly felt through the skin.

February 20th.—The displacement of globe forward and downward has increased. The emphysematous tumor reaches now 5 *mm.* above upper border of orbit, outward to a vertical line drawn through outer canthus upward. V = $\frac{6}{6}$, both sides. R. E., M = $\frac{1}{36}$; L. E., H = $\frac{1}{24}$. Tension considerably increased. Field and ophthalmoscopic condition normal.

March 3d.—For a few days past, the swelling has remained stationary, and no longer diminishes under pressure or rubbing. The percussion sound over it still full-tympanitic. The upper boundary of the swelling forms a curved line, which begins at the supra-orbital border above the outer canthus, reaches its highest point 5 *mm.* above the middle of the eyebrow, and extends inward to a point straight above the lachrymal sac. Downward the tumor stretches to the middle of upper lid, where a superficial transverse fold of skin marks its lower boundary.

March 14th.—An exploratory puncture, in which the needle of the syringe encountered considerable resistance, discharged only air, and even by suction no other contents could be obtained.

The swelling was so much diminished by the puncture, that the upper border of the orbit could be easily explored. By this it was perceived that from the point where the frontal joins the malar bone, the border was thickened and scooped out as if by a chisel. Three *mm.* from the lateral border of this excavation, inward and upward, was felt a smooth, hard peg-like body, projecting about 5 *mm.* from the border of the bone above. At a distance of 3 or 4 *mm.* to the nasal side, a second peg-like body, 11 *mm.* long and 3 *mm.* wide, projects downward parallel to the first; 3 to 4 *mm*, still farther to the nose, there is a third, about 12 *mm.* long and 5 *mm.* broad at its origin from the frontal. These three projections are firmly attached to the bone.

The lower end of the middle peg displayed a slight cartilaginous elasticity. The longest, most inward peg reached directly to the equator of the globe. The globe is crowded to the lower wall of the orbit. The lower border of right orbit seems perfectly intact and entirely symmetrical with that of left.

The exophthalmus amounts to 7 *mm*; the vertical difference in positions of apices of corneæ, 9 to 10 *mm*. The excursion of right eye downward and outward, in slight degree painful and restricted. V = $\frac{6}{6}$, both sides. R. E., M = $\frac{1}{36}$; L. E., H

$= \frac{1}{12}$. Right eye: tension markedly increased; ophthalmoscopic condition normal. Upper section of right bulbar conjunctiva somewhat injected. Pupils equally dilated; reaction correct. Sensitiveness of skin of forehead same on right as on left half. In order to avert any further peril to the eye from the bony projections which are growing downward, I recommended to the patient their removal by operation.

On 2d April I undertook the operation at the surgical clinic of Prof. Von Rzehaczek, and with his kind assistance.

After patient was anæsthetized, the skin of the forehead was stretched upward, and an incision made through the skin and subcutaneous cellular tissue, directly under and along the lower border of the eyebrow, commencing at outer angle of the orbit, and reaching nearly over the upper border of the lachrymal sac.

As I reached the periosteum in the region of the upper orbital border, I saw it stretched and somewhat arched over a darkly translucent cavity. I made section of the periosteum in full length of the cutaneous incision, and detached it for a width of 3 *mm.* from the frontal bone above.

With this the above-mentioned cavity was opened. As its contents, I found, besides air, two larger ridges and one smaller, of reddish-gray-colored spongy bone, which projected downward against the eyeball. These ridges had their origin in a mass of fine spongy bone which formed the roof of the orbit; they extended 2 *cm.* into the depth of the orbit, and formed therein a comb, over which the periosteum of the roof of the orbit was stretched in such way that it came in conjunction with the bone substance only at the lower free border of this comb. The periosteum constituted the floor of the pneumatic cavity described. The top and sides were formed in shape of a vault of rough and spongy bone, from which the above-described combs projected like stalactites.

The three bony combs were loosened and removed by the chisel. Now, as the finger was forced into the cavity along the floor, it felt that the periosteum, which had been stretched over the combs of bone that were removed, contained small hard plates of bone enwoven in it, which with low bare ridges stood forward somewhat into the cavity. I dissected carefully these pieces out of the periosteum. On pressing still deeper into the cavity, the finger came in contact along the roof with still greater numbers of large and small comb- and peg-like bony outgrowths, which

sprang out from the spongy frame work of the roof of the orbit. These were also removed with the chisel, in which, as in removal of the three bony combs, I was astonished at the softness and lack of resistance of the bony substance.

Notwithstanding I pressed very deeply in the direction of the frontal sinus in the exploration described, no separate bony cavity was found which could be regarded as a frontal sinus. Equally little did I succeed in passing a probe through the spongy roof of the orbit into the nasal cavity.

After all remaining unevenness of the covering of the cavity had been, so far as possible, smoothed off with a sharp scoop, leaving as roof of orbit a somewhat smooth-bordered mass of porous bone, the globe could be replaced into its normal position. After careful cleansing of cavity with a two-per-cent. solution of carbolic acid, the edges of periosteal incision were brought together with cat-gut sutures as far as the inner angle of the wound, where a drainage-tube was left. The outer cutaneous incision was closed with silk as far as the drainage-tube. The patient remained for after-treatment in the surgical clinic.

April 3d.—First change of bandage.

April 4th.—Removal of the cutaneous sutures and drainage-tube. The wound of skin for most part healed by first intention. A quantity of healthy-looking pus discharged from inner angle of wound. From this time on a change of bandage twice a day. Most of secretion of good-looking pus; no fever, no headache. A preliminary test shows that the functions of the right eye are perfectly preserved.

April 10th.—Patient discharged with simple protective bandage, and placed in out-door department. In inner angle of wound there remains a fine fistulous opening, out of which pus still discharges.

May 12th.—The opening at inner angle of wound closed by crusts. The upper lid swollen and œdematous. After removal of crusts, pus escapes from the fistulous opening.

June 14th.—The wound entirely healed. On the right upper lid, 5 *mm.* under and parallel to the eyebrow, can be seen a fine rose-colored scar, whose inner end is united to the bone. The upper orbital border is somewhat rounded off and more arch-shaped than the left. The surroundings of the eye entirely normal; the closure of the lid perfect. The right eyeball is of same height as left; the exophthalmus entirely gone. V = $\frac{6}{6}$, both sides. R.

E., H = $\frac{1}{24}$; L. E., H = $\frac{1}{24}$. The visual field of both eyes entirely congruous. Sensibility of skin of forehead shows no difference between the two sides. Forced expiration, with nose and mouth closed, does not make any perceptible change in neighborhood of right orbit.

I saw patient for last time on 28th Dec., 1882. The scar had grown paler; otherwise *status idem.*

Finally, before going into the pathogenesis I will say a few words as to the change in refraction occurring in the right eye during the course of the disease.

As is seen from the above data there was, during the disease, a constant increase of refraction in the diseased eye, from H = $\frac{1}{24}$ to M = $\frac{1}{30}$. That this increase was produced by the elongation of the optic axis caused by pressure on the globe from above downward by the bony ridges, is little to be doubted, as the original refractive condition is seen to re-establish itself as soon as these ridges are removed.

Making calculation of the increase of the optic axis during the course of the disease: given that for H = $\frac{1}{24}$, there is a shortening of the axis 0.45 *mm.* in comparison with the emmetropic eye, and for M = $\frac{1}{30}$, a lengthening of the same of 0.38 *mm.* in comparison with the emmetropic eye, we have an increase of optic length of 0.83 *mm.*

Increase in refraction of the eye, conditional on lateral pressure from orbital cellulitis, has been observed by Tavignot; from tumor of orbit, by Galézowski; finally, in erysipelas faciei by Cuignet. Still it may not be unimportant to especially lay stress on this condition, for in our case the constant increase of refraction until the operation, and its return to original condition after it, could be established by exact subjective and objective experiments.

In order to have light on the before-mentioned case, the pieces of bone removed by the operation were subjected to microscopic examination, and I will now in the following pages call attention to the results of this examination; and then, from this and the course of the disease as a basis, I will endeavor to determine the pathogenesis.

For purposes of microscopic examination the combs and plates of bone, mentioned in description of the operation,

were laid in Müller's fluid and kept immersed until they no longer offered any especial resistance to the section-cutter. The pieces of bone, after removal from Müller's fluid and hardening in alcohol, were cut into sections in various directions; parts were examined uncolored in acetic acid, parts in glycerine after staining in thin neutral solution of carmine.

The method of preparation described presents the advantage that the differentiation between the still uncalcified parts and the remaining calcified bony tissue is brought out distinctly in the sections. I found, in fact, in several spots of the specimen and in different expansions, the bony tissue still uncalcified, as I had already been made to anticipate from the rapid development of the bony masses, and from their surprising softness noticed during the operation.

Further, there was no especial difference in their histological relations between the little bony plates found in the periosteum and the three ridges of bone which projected from roof of the orbit into the cavity filled with air.

Next, as to the bony plates found in the periosteum, they are to be divided, as already referred to in the history of the operation, into the thin, smooth ones, and the thicker kind, with ridges projecting from them into the cavity. The first consist, in their superficial parts most removed from the cavity, of interlaced star-shaped growths of bone tissue, rich in large bone corpscules; which tissue, up to the superficial parts as well as in the pericellular zone around the large bone cells (1), is calcified regularly or in granular lumps.

The superficial uncalcified parts mentioned run for the most part directly into the fibrous periosteal tissue (as Sharpey's bundles), between which numerous osteoblasts are confined.

Here and there the superficial bone tissue presents a globular appearance. In spaces the thin bony plates are bordered by surfaces in a state of absorption in the lacunæ of which osteoblasts are still lying. At many places I found these absorption surfaces covered entirely or superficially by uncalcified bone strata (see Fig. 5), which are covered over by osteoblasts or contained in a sort of cambium reticulum.

In a few preparations the thin bone plates superficially were found lamellated, and therewith possessed of numerous penetrating vessels. These beds of lamellated bone toward the deeper parts changed directly into recticulate growths of bone structure rich in cells.

At the other places, on the contrary, the thin bone plates passed outward into the stiff fibrous stratum of periosteum by single spurs and tongue-shaped trabecles of lamellated bone. At different depths, mostly slight, under the outer surface of the thin plates, partly in transverse, partly in longitudinal, sections, one encounters everywhere rather narrow vascular canals and spaces filled with marrow rich in cells. These are surrounded partly by cancellated bone, partly by lamellar systems, which are divided from the remaining reticulated substance by cement lines. By this the bone substance is here, also, almost throughout homogeneously calcified in masses covered by dense layers of osteoblasts. I encountered many other vascular and medullary spaces which were in process of lacunar absorption. In one part of the plates the lamellated bone structure preponderated in volume over the non-lamellated, and the lamellæ formed in reality not only closed Haversian systems but had here and there a straight course, sometimes a direction parallel to the surface, and communicated by cement lines with each other,—that is, they are intercalary pieces.

In isolated spots I found inside of these compact lamellated portions of bone, also transverse sections of perforating canals which had come to obliteration through uncalcified bone substance. On the interior surface of the cavity, the plates pass into the enveloping periosteal tissue, partly in form of Sharpey's fibres, partly through more or less wide layers of reticulated bone substance rich in cells.

The structure of the thicker plates presented the peculiarity of containing still larger, deep-seated medullary spaces, which gave the plates a spongy appearance.

These medullary spaces were partly in condition of lacunar absorption; but the surrounding lamellar systems were for the most part intact.

Between these lamellar systems of medullary spaces were

found intercalary pieces, either single and isolated, or united in shape of lattice-work, hollowed out of reticulated bone tissue.

The innermost parts of the plates were demonstrated as of cancellated bony framework extremely rich in cells. This reticulated framework enclosed for the most part straight vascular spaces; many of the latter were, however, also surrounded by unorganized, more or less distinctly lamellated, structures of bone substance, which presented thereby great resemblance to certain forms of bone in the new-born.[1]

The lining zones of the above-mentioned medullary spaces, as well as those of the vascular canals in the cancellated framework, were uncalcified, and for the most part covered by thick layers of osteoblasts. (See Fig. 5.)

The construction of the ridges mentioned above as projecting from the plates into the cavity, is essentially that of the thick spongy plates, only here the medullary spaces are confluent in such a manner that their construction is much looser. The reticulated framework of which the ridges are built is formed in only a slight part of cancellated bone substance: for example, in some superficial portions and in isolated intercalary pieces; the remainder is of unorganized and irregularly lamellated tissue, and toward the medullary spaces is surrounded by thin uncalcified zones, which are here and there covered with small spindle-shaped osteoblasts. But in many portions of the ridges the reticulated framework shows lacunar erosion. As contents of the spongy spaces I encountered here a medullary tissue, poor in cells and composed almost entirely of connective-tissue bundles and of blood-vessels. Further, it is also to be mentioned that on quite extensive spots which corresponded to the lateral surfaces, the framework of the same was shown to be covered by thin smooth-bordered bands of connective tissue, which, whilst closing the superficial open medullary spaces, embraced closely the framework and its projecting ends, con-

[1] See v. Ebner on the finer structure of the bone substance. Transactions of the Imperial Academy of Sciences in Vienna, Vol. LXXII, Chap. 3, Year 1875, Plate III, Fig. 20.

taining here also quantities of large, oval osteoblasts in absorption lacunæ.

It now remains still to go into consideration of the construction of the three bony combs which were resected. These correspond in their structure with each other and with the periosteal plates described before, in so far that their framework is built up almost exclusively of a net-work of bone tissue extremely rich in cells. As regards the arrangement and thickness of their framework, some differences are really to to be observed, though I regard it unnecessary to go into them further, and cite to Fig. 4, which gives an illustration of the construction of one of the above-mentioned combs.

Now in glancing over the explanation of the microscopic condition for purposes of diagnosis, it demonstrates itself, without going further, that in case of the bone plates and combs examined, we had to do with osteophytic formations, as the macroscopic condition had already with great probability led us to suppose.

The projection and detachment of the examined pieces of bone from the normal surface of the bone, the irregularity of their configuration, and their broadening out near the surface; finally, the manifold non-lamellated[1] but globular and radiating structure, characterize them with all distinctness as to be placed with abnormal, inflammatory, periosteal new-formation of bone substance, therefore of osteophytes.

The fact that one part of the bone pieces examined was more or less lamellated in structure can change nothing in this diagnosis, as always in long-standing osteophytes, and certainly predominantly after advent of local absorption, the appearance of lamellated bone takes place; but besides this, in the narrowing of the vascular spaces in the osteophytic reticulated framework, even without preceding absorption, the bone structure approaches to the lamellar form.[2]

We have now only to consider the question: Whence, in the described case, came the irritation for the development of

[1] Compare Förster: "Handbook of Special Pathological Anatomy," vol. 2, p. 878. Leipzig, 1863.

[2] Compare Virchow: "Cellular Pathology," vol. 4, p. 514. Berlin, 1871.

the osteophytes, how it hereby came to development of the pneumatosis, and in what relation the latter stands to ectopia of the globe? That we have not in this case to do with an emphysema of lid or of the orbital tissue is already clear, so much the more so as in the operation the swelling containing air was shown to be covered in front with periosteum.

As to the question of the site of the irritation which caused the growth of the osteophytes, the most correct supposition seems to me to be that of an inflammatory though non-suppurative affection of the frontal sinus, which, in the course of the disease, affected sympathetically the periosteum of the frontal bone and of the roof of the orbit, bringing them into a condition of irritation which gave the impulse for the development of the osteophytes.

The thought that the origin of the disease was in the frontal sinus is very natural. It had forced itself on me already before the operation, as the localization of the pains, and the dull headache which had affected the patient already in the beginning of the trouble, pointed to the frontal sinus, and the appearance of the pneumatosis of necessity strengthened this supposition.

The fact that the pneumatosis first appeared in forced expiration, by sneezing, and could afterward be again produced by increase of air-pressure in the nasal cavities, makes it impossible to doubt that an opening into the frontal sinuses had occurred.

This opening could have been brought about undoubtedly by a primary disease of the outer periosteal covering of the frontal bone, but for the supposition of such primary disease of the outer frontal periosteum there is absolutely no support in the history of the disease. The patient felt in the commencement of the disease no pain—either spontaneous or by pressure—on the border of the orbit. There was never a moment in his memory, when there was any thing which could point to a primary commencement of external frontal periostitis.

On the contrary, it is known that the frontal sinuses, with their communicating nasal cavities, frequently become dis-

eased without external visible cause, even in the course of entirely unnoticed inflammations, catarrh, etc., etc.[1] In addition, it is also favorable to my supposition that, in the course of the operation, as already mentioned, there was no particular frontal sinus discovered, but in its stead only spongy, apparently new-formed, bone.

According to my view, it is more a question of the nature of the accepted primary disease of the frontal cavity, and how, in its course, came about the development of the pneumatosis? To the first question there is not a decided answer, so much only may be accepted with great probability, that it was an inflammatory, though non-suppurative, process, as in course of the operation I encountered neither a neoplasm nor any fluid inflammatory product, It is easy to find an explanation of the development of the pneumatosis also, if we accept that, in the course of an inflammatory, non-suppurative condition of irritation of the investing membrane, the formation of osteophytic growths occurred in the frontal sinus affecting the outer periosteum of the frontal bone.

It is known and easily demonstrable by histological investigation,[2] that in course of the existence of the osteophytes, not only the osteophytic structure itself, but the shell of old bone underlying it, undergoes absorption.[3] A fact for this belief is afforded by the experience which has been collected by authors in the investigation of callus, that old bone under the superimposed callus always becomes thinned by lacunar absorption.[4]

I wish, therefore, to convey the impression that in our

[1] Compare F. Steiner: On the Development of the Frontal Sinus and their Diseases. *Langenbeck's Archiv*, vol. xiii. Berl., 1872. Zuckerkandel: Normal and Pathological Anatomy of the Nasal Cavities and of their Pneumatic Appendages.

[2] Rud. Maier: "Text-book of General Pathological Anatomy," page 210. Leipzig, 1871.

[3] Compare Förster: *loc. cit.*, page 878.

[4] Compare Volkmann: The Disease of Bone in "Hand-book of General and Special Surgery" of Pitha and Billlroth, Erlangen, 1865, vol. ii, part 2, page 373, description to fig. 73. C. Heitzmann: "Compendium of Surgical Pathology and Therapeutics," 3d edit., Vienna, 1871, page 447. Lossen: On Formation of Callus, *Virchow's Archiv.*, 1872, page 48. A. Thierfelder: "Pathological Histology of Bone and Periosteum." 5 vols. post 8vo, 3 of Atlas, Leipzig, 1876, explanation to plate 28, fig. 1.

case by growing out of the osteophytes which clothed within and without the lower wall of the frontal cavity, absorption in one or another or perhaps in many places occurred during the course of the disease, in the old as well as in the newly imposed bone tissue; so that the air passed out of the nasal and frontal cavities through the spongy osteophytic tissue, to appear under the periosteum, where, as already mentioned, it was demonstrable before as well as during the operation.

The further supposition, that the condition of irritation, and with it the process of deposition continued in the osteophytes explains the fact that for a while before the operation the pneumatic swelling could no longer be removed by pressure. The aperture of communication was more or less obstructed in a valve-like way by the bony new-formation.

In conclusion, it remains to discuss briefly what influence the pneumatosis on the one hand and the osteophytes on the other had on the ectopia of the globe.

According to my idea, we have to seek chiefly in the osteophytes the origin both of the exophthalmus and of the downward displacement of the eyeball; for the clinical history shows, that the ectopia of the ball in both directions was already present some time before the pneumatosis appeared. It was only in that period of the disease when the growth of the bony combs was not yet far advanced that a slight increase of the ectopia of the globe was produced by forced expiration.

The pneumatosis never had any influence on the exophthalmus, which was caused exclusively by the osteophytes at the posterior part of the roof of the orbit.

Explanation of the Illustrations on Plates VII and VIII.

Fig. 1. Appearance of eye before the operation, taken on 20th March, 1882.

Fig. 2. View of cavity containing air, as it appeared after discission of the periosteum, with the three bony combs projecting forward into the cavity.

Fig. 3. Appearance of the eye after healing of the operation wound. Taken 14th June, 1882.

Fig. 4. Longitudinal section through one of the resected combs of bone. A richly-branched reticulated framework, chiefly a net-work of bone tissue, forms the wall of a larger medullary space (covered by portion of the fibrous periosteum), in the point directed downward of one of the bony combs. Toward the surface of resection the reticulated framework is much denser. The trabecles are for the most part calcified. The uncalcified portions are darker in the drawing (in the preparation colored red by carmine). Magnified $\frac{1}{1}\frac{0}{0}$.

Fig. 5. Portion from the vicinity of a medullary space in one of the thicker periosteal plates. Densely placed osteoblasts cover the uncalcified bordering zone of the medullary space. The calcified bone tissue, clearly shown in the picture, contains very numerous, irregular, large bone cells, which are confluent with one another in different ways ; in the vicinity of which the bone substance, in a pericellular zone, is uncalcified. Beyond this are islands of different shapes and free of lime, in which small cells can be distinguished. The portions which are free of lime are represented by a gray shade in the illustration. Magnified $\frac{3}{1}\frac{0}{0}\frac{0}{0}$.

A PECULIAR ANOMALY OF THE OPTIC NERVE.

By D. O. PURTSCHER, in Klagenfurt, Austria.

(*With drawing, fig. 6, on plate viii.*)

Translated by Dr. J. H. Shorter, New York.

THROUGH the kindness of Staff-Surgeon Janeschitz and of Regimental-Surgeon Liebl, I had opportunity a few days since of observing a singular anomaly of the transverse section of optic nerve in case of a recruit.

Anton Eggen, twenty years old, of Reichenau in Carinthia, is of very strong physique; his intelligence, on the contrary, is very slightly developed. He pretends not to see very well in the distance, though he thinks he has never seen any better.

Testing vision gives, in each eye, $\frac{6}{12}$ Snellen without correction by glasses. With weak concave glasses the sight improves to $\frac{6}{6}$ full. The indication for strength of glasses varies somewhat.

Ophthalmoscopic examination shows nothing surprising in right eye. The optic nerve shows a somewhat large but shallow physiological excavation, without sharp edges; besides this, a weak myopic condition.

The left eye, on the contrary, shows a different condition. (See drawing, fig. 6, plate viii.)

The optic nerve, other than the peculiarity to be spoken of, presents entirely normal relations. There exists a somewhat sharp-bordered physiological excavation lying concentric to the periphery of the optic nerve, whose diameter is about equal in length to the radius of the optic disc.

For an emmetrope with accommodation relaxed, about — 0.75 is required to bring distinctly into view the vessels of the border of the optic nerve, including those of the non-excavated part of the disc as well as those of the adjacent fundus. The bottom of the excavation is only seen distinctly with — 3.0 or — 3.5.

In contrast to this, another part of the transverse section of the optic nerve requires for correction a convex glass, in reality at least a + 1.0.

The large venous branches which join the lower branch of the central vein, in this case two in number, have outside the disc a rather tortuous course. They join together, before entering the depth of the head of optic nerve, into a peculiar plexus, which, as it passes forward over the lower border of the excavation, parallel to the surface of the transverse section of the optic nerve, makes a sharp contrast to the excavation lying below. The lower branch of central vein, resulting from union of the two veins, seems to run directly backward, almost perpendicularly, from the plexus (T-shaped).

But it is not only the point of junction of the two venous branches that separates itself sharply from the background, but the venous trunks themselves contrast sharply with the adjacent parts ; for instance, with that part of the disc not comprised within them, toward which, especially in a lateral direction, they present a very decided parallactic displacement, which is marked particularly clearly at the lower-outer and lower-inner borders of the optic nerve.

For a clear view of the above-described venous branches, as well as for their plexiform union, at least a + 1.0 is required, whereas the entire border of the optic nerve almost to the ascending venous trunks is clearly seen with — 0.75.

The descending branch from the central artery is also first seen sharply with + 1.0. The lower part of the optic nerve—that is, the part confined within the branches of the central vessels which come from below—presents the same condition.

This part of the optic-nerve border shows, besides this, a more than usually clearly pronounced radial striation, which can be followed quite far into the retina. The light hazy reflex of the normal retina about the optic nerve is also especially developed here. Outside of that sector of the fundus comprised within the inferior retinal vessels, the transition from the striated haziness into the neighboring normal retina is quite sudden. Inward from the middle lower branch of the central vein, by tilting the mirror, a striated, very variable reflex from the adjacent retina is especially perceptible.

The anomaly in the optic nerve under consideration consists in the sudden elevation of a sector, and especially of

the vessels of this part, almost $\frac{1}{3}$ *mm.* above the normal level of the disc. The anomaly of the fundus is so striking that even an unpractised ophthalmoscopist could have immediately noticed it. The image of the lower part of the optic nerve reminds one of choked disc, but any pathological condition can be excluded by its monocular character, and especially by its limited extent, and so much the more readily as all functions of the eye as well as of the individual are entirely normal.

INVESTIGATIONS ON THE INTERCHANGE OF LIQUIDS IN THE EYE, BY MEANS OF SUBCUTANEOUS INJECTIONS OF FLUORESCIN.

By Dr. RICHARD ULRICH,

LECTURER AT THE UNIVERSITY AND FIRST ASSISTANT SURGEON AT THE OPHTHALMIC CLINIC, IN STRASBURG.

Translated by H. Knapp.

THE experimental investigations on the currents of liquids in the eye of the rabbit published by Ehrlich[1] are in some points at variance with the results of investigations published by me before.[2] Ehrlich's experiments consist in subcutaneous injections of fluorescin and observations of the occurrence of the coloring matter in the eye of the living rabbit. These injections have been repeated by Pflüger and others, most extensively by Schöler and Uthoff (Annual Report of Schöler's ophthalmic clinic). The results obtained by these observers, though the experiments were conducted according to the same method and with the same liquids, differ essentially from those obtained by Ehrlich, and in many points also from my own. I thought it incumbent on me to repeat the experiments of Ehrlich, with a view of detecting the cause of these differences. I think the following communication will show that I succeeded in my endeavor.

Some preliminary remarks will not be out of place. Fluorescin is a coloring matter which is brown-red in a concentrated solution; in weak solutions it fluoresces yellow, or, under certain conditions, green. The green fluorescence depends upon the thickness of the stratum of liquid which

[1] *Deutsche med. Wochenschr.*, No. 2, etc., 1882.

[2] *Graefe's Arch.*, vol. xxvi, No. 3.

contains the fluorescin, and upon the background before which this stratum is situated.

A very simple experiment will account for these differences: Around a plate of red glass wrap white paper from which a round piece is cut out; place it in a glass filled with water, so that only a thin sheet of water is in front of the paper, thus coarsely imitating the conditions of the anterior chamber of a white rabbit. A drop of a solution of fluorescin, let fall on the surface of the water in front of the diaphragm, slowly sinks to the bottom. During its course through the water in front of the paper it is either invisible (if the solution is greatly diluted) or very faintly yellow; when, however, it is in front of the hole in the paper, it shines in beautifully green fluorescence, to disappear again when it descends before the lower part of the paper. The reason of this is very simple. The proper light of the paper outshines the fluorescence of the liquid. The narrower the stratum of liquid in front of the paper, the more this phenomenon is pronounced, which can be easily demonstrated when the paper is held near the wall of the glass (empty anterior chamber).

From this experiment the conclusion can be drawn, even before fluorescin has been injected, that the fluorescence must appear most marked in front of the pupil, because in this place (1) the anterior chamber is deepest, and (2) the proper light of the iris is least disturbing. The disturbance from a light iris is, of course, greater than from a dark one.

The iris itself, even if impregnated with a solution of fluorescin, does not fluoresce in dark rabbits, and only little in white ones, but appears distinctly yellow in the latter, the same as the palpebral edge, the ocular conjunctiva, and the general integument (Ehrlich, Schöler, Uthoff). The reason of this is, that the white iris is not transparent enough to admit of light being reflected from sufficiently thick layer of tissue, whereas in the dark iris even the surface absorbs too much light.

It is strange that neither Ehrlich nor Schöler and Uthoff mention the yellow coloration of the iris. I can explain this only by the supposition that they omitted to experiment on white rabbits.

The yellow coloration being as characteristic of the presence of fluorescin as the fluorescence, it is clear that experiments on white rabbits only can yield trustworthy results.

Ehrlich states that after paracentesis of the cornea in a rabbit injected with fluorescin, the pupillary edge soon shows an intensely shining green coloration, which first spreads over the area of the pupil, and, later, over the entire anterior chamber. He says nothing of the condition of the iris, but jumps at once at the conclusion that the regeneration of the aqueous humor, after paracentesis, proceeds from the ciliary processes through the posterior chamber without participation of the iris. I shall discuss this opinion after I have described the results of my own experiments with subcutaneous injections of fluorescin in albinotic rabbits.

Soon after the paracentesis of the cornea, the pupillary and peripheric parts of the iris, almost simultaneously, show a yellow coloration which rapidly extends over the entire surface of the iris. After this, green fluorescing clouds are seen, principally at the superior margin of the pupil, to descend through the pupil, and disappear at its lower edge. In a short time, however, a green coloration extends from the whole edge of the pupil toward its centre, and a so-called lenticular green fluorescing pupillary exudation forms, which either stays *in loco* or descends with the removed aqueous, like an hypopyon, to the bottom, and at last fills the whole anterior chamber. Under these conditions the pupil, in some cases, appears in the most beautifully green fluorescence, whereas the iris is light yellow.

On the whole, like the other observers, I received the impression that the new aqueous appeared at the edge of the pupil. Was this true, or was I deceived by the greater intensity of the fluorescence in the pupil? Could the aqueous not proceed from the vessels of the pupillary edge of the iris, as I had concluded from my former experiments?

Though I did not find a pupillary exudation extend behind the iris in my former experiments with ferrocyanide

of potassium, I dilated, with atropia, the pupil in cases in which, after the paracentesis, a typical fluorescing pupillary exudation had formed. In these cases the edge of the iris was found partially agglutinated to the anterior capsule of the lens by posterior synechiæ, the pupil dilated only in part, but the free portions of the capsule were devoid of fluorescing exudation, which, consequently, did not extend along the posterior surface of the iris.

Not satisfied with this negative result I returned to my former method with ferrocyanide of potassium, modifying it somewhat. As I have formerly pointed out, it is quite important to interrupt the experiment at the right time. This is best indicated when fluorescin, mixed with equal parts of ferrocyanide of potassium, is injected subcutaneously. If we wish to fix, *i. e.*, to preserve, a given stage of fluorescin coloration in the iris or anterior chamber we have but to kill the animal, quickly to open the anterior chamber, and instil a solution of bichloride of iron in alcohol. The instantaneous formation of Berlin-blue fixes the limit to which the fluorescin has advanced, how long soever the eye may be left in the alcoholic solution of bichloride of iron. The eyes thus prepared were examined both macroscopically and microscopically. Besides the deep-blue lenticular exudation in the pupil some fibrinous flakes were found upon the ciliary processes. From the posterior surface of the iris some thin shreds could be detached which under the microscope proved to be composed of fibrine filaments, but a continuous layer of exudation from the anterior chamber into the posterior could not be detected. The posterior surface of the iris did not adhere to the capsule. It follows that there was no positive evidence of the assertion that the regenerated aqueous passes from the posterior chamber into the anterior around the edge of the pupil, neither was the contrary conclusively proven. In my former paper I expressed the opinion that the regeneration of the aqueous after punction of the anterior chamber proceeded in general from the dilated vessels of the edge of the pupil, not from the periphery of the anterior chamber as under

normal conditions. Now, like Ehrlich, I consider it probable that the aqueous, after paracentesis, is regenerated from the posterior chamber, though I have been unable to demonstrate it.

What are the phenomena of fluorescence in the intact eye after subcutaneous injections? The coloration is first discernible at the periphery of the iris,—if the experiments are made on white rabbits. Long after this ring-shaped yellow streak we notice the well-known vertical line of Ehrlich, which its discoverer thinks to be produced by a whirlpool-motion. I concur with Ehrlich in the description of this line. It always extends beyond the pupil, but does not quite reach the scleral border. In its upper part I have seen it broaden into a triangle and connected with the ring-shaped coloration of the iris. The explanation of Ehrlich, I think, is incorrect. I must positively assert that this line is nothing but a descending drop, the direction of which in the quiet eye is exclusively determined by gravity. The line is always vertical, howsoever the orbit and the eyeball of the animal may be placed.

The formation of Ehrlich's line is, in my opinion, to be explained as follows:

The ring-shaped peripheric coloration of the iris is produced by the appearance of aqueous secreted on the surface of the iris in that place. As, however, it is so near its outlet, Fontana's space, its greater part at once escapes at the bottom and on the sides of the anterior chamber; at the top only, the escape is retarded by gravity. A drop collects there in the narrow sinus of the chamber, adhering in front to the cornea, behind to the iris, until gravity overcomes the adherence, the drop detaches itself and slowly sinks down—the line of Ehrlich. This also explains why, as Ehrlich first noticed, the line forms a spherical triangle at the top.

By the kindness of Prof. Kundt, director of of the Physical Institute at Strasburg, I was enabled to repeat my experiments by spectral light. The ultra-violet rays furnished no result, probably because they are absorbed by the cornea.

Blue spectral light, however, showed the phenomena of fluoresence in the rabbit's eye most beautifully. Several persons have convinced themselves that Ehrlich's line is produced by a drop sinking from the sinus of the anterior chamber down to the bottom. If the animal is placed on its back the line assumes another direction, following in this, as in all other positions, the law of gravitation.

Of many other coloring substances which I have tried, only a so-called azo-pigment, the coccinin, was of some advantage. It has, however, the disadvantage that it must be injected warm, and congeals rapidly.

In conclusion, a few words on the action of eserine. In the myotic eye, the action of fluorescin is more rapid and more intense, and extends more quickly over the whole iris, sometimes so that the colorations from the ciliary and the pupillary edge travel toward each other; but its effect seems also to disappear more quickly.

I have never seen the green fluorescence in the lens of a living animal, but always the normal blue-violet fluorescence.

Without heralding, like Schöler or Uthoff, fluorescin as the long-expected savior of experimental physiology, we must consider it as a very valuable addition to the means of investigation. With gratification I have found that the results of my experiments with fluorescin perfectly tallied with those obtained by means of ferrocyanide of potassium. Ehrlich confirms the two naked facts that the regenerated aqueous humor, after paracentesis, appears at the pupillary edge, whereas, under normal conditions, it appears at the periphery of the sinus of the anterior chamber. If he differs from me in the explanation of some details, I hope that the foregoing lines will pave the way to an agreement of opinion.

NEURASTHENIC ASTHENOPIA AND SO-CALLED ANÆSTHESIA RETINÆ.

By Dr. HERMANN WILBRAND, of Hamburg.

Translated by Drs. Porter Farley, of Rochester, N. Y.; J. A. Spalding, of Portland, Me.; and C. Zimmermann, of New York.

(*Plates iii, iv, and v.*)

ANÆSTHESIA retinæ is not an independent disease, but is the local expression of a general nervous diathesis. Now this general nervous condition presents definite characteristics, and may prove to be the prodromal stage of hysteria and still more serious organic disturbances. In like manner, these local symptoms which we commonly recognize under the name of anæsthesia retinæ, occur in all the developmental phases of these general nervous conditions and severe organic nervous diseases. The name "anæsthesia retinæ" is, however, objectionable, for the reason that, coexisting with the assumed anæsthesia, there is always a hyperæsthetic condition of the nervous visual apparatus, and the results of examination, such as the frequent normal appearance of the fundus, the persistence of phosphenes, and the normal reaction of the pupils, positively exclude the idea of a serious disease of the retina—such as is naturally suggested by the great changes in the visual field. Accordingly, some authors—for instance, Leber—protest against the correctness of the name "anæsthesia retinæ," but still employ it, because its meaning has become established; others—for instance, Mooren—designate the condition sometimes as anæsthesia, sometimes as hyperæsthesia, the choice of name being determined by the relative prominence in each particular case

of increased irritability on the one hand, or decreased functional ability on the other.

This condition is characterized by symptoms related not alone to the optic nerve, but by analogous and equally important ones related to the entire nervous system. These symptoms are partly vicarious and partly affect, simultaneously, different organs of the same individual, quickly changing their locality and sometimes quickly disappearing. Now the pathological basis for the explanation of all these symptoms is one and the same. The symptom which we have been accustomed to regard as generally characteristic of anæsthesia retinæ, is, like the copiopia hysterica, so strikingly described by Förster,[1] simply a local manifestation of that nervous diathesis which, according to Beard,[2] is essentially an impoverishment of nerve-force dependent upon an excessive waste of nerve-tissue. Rudolph Arndt describes this cardinal symptom as consisting in hyperæsthesia, quickly followed by fatigue, making itself specially manifest in severe cases of hysterical tendency by exaggerated reflex activity.

From a purely pathological stand-point, and without reference to the existing etiological conditions, we have here to do with disturbances dependent not upon definite lesions of the nervous system, but, so to speak, upon molecular anomalies not at present understood. Such conditions are generally designated as "functional diseases."

The term "anæsthesia retinæ" is objectionable, because there are always present other equally important symptoms relating to the general nervous condition. We would prefer as descriptive of this pathological condition in the eye the name "neurasthenic asthenopia," as proposed by Beard, particularly after analysis of the following cases, which show that in almost all neurasthenic patients there exist, in addition to the symptoms of copiopia hysterica, all those other symptoms described by Förster[3] as characteristic of the visual field in anæsthesia retinæ.

[1] *Gräfe-Sämisch*, Bd. vii, p. 88.

[2] "Neurasthenia," by Geo. M. Beard.

[3] Gesichtsfeldmessung bei Anästhesie der Retina, *Sitzungsbericht der Heidelberger ophthalm. Vers.*, 1877, p. 162.

The observation of this condition in the eye is of special interest, because we can, from time to time, map out the visual field and test the acuity of vision, thus determining the functional activity of the optic nerve in such a manner that the results can be recorded, and so making available certain objective symptoms while the other symptoms are mostly subjective.

The object of this paper is to show:

1. That in neurasthenic patients, along with copiopic disturbances, we find all grades of symptoms of so-called anæsthesia of the retina.

2. That these symptoms, on the part of the nervous elements of the eye, are due to the same causes as are the analogous symptoms manifested by the same patient in other parts of the body; and

3. That it is a mistake to regard anæsthesia retinæ as an independent pathological condition.

For a proper understanding of the condition which we find described as anæsthesia retinæ, we must consider, and properly value, all the symptoms manifested by the patient.

We now proceed to the description of particular cases, and by setting forth all the symptoms, hope to prove that in neurasthenic patients, the so-called retinal anæsthesia is found in all possible degrees of intensity and variability. But first allow me a few words explanatory of the accompanying plates representing the visual field, and of the manner in which the examinations were made.

Förster's perimeter was employed, and a white object, five square millimetres in superficial extent, was moved along the different meridians across the entire field, in the direction indicated by the full-line arrows. The order in which the meridians were examined is shown by the numbers along the outer circle. Observe particularly that the examination was always begun in the horizontal meridian, and was followed out in the order indicated by the figures 1, 2, 3, 4, etc.

In this manner we obtained diagrams of the visual field, taken always under the same uniform conditions; that is,

the nervous system of the eye had been at rest when the examination was begun in the horizontal meridian, and it became progressively exhausted as the examination was carried on; the fatigue manifesting itself by steadily diminishing the visual field until, in some cases, when the ninth meridian was reached, the nervous power of the eye seemed entirely exhausted. It must be understood that throughout the examination the eye is kept constantly fixed upon the fixation-object—a white ball presenting a disc of about five square millimetres.

After the visual fields are determined, and their boundaries mapped out as shown by the heavy lines in the figures, this peculiarity is to be observed: that at the left extremity of the horizontal meridian—that is, at the place where the examination begins—the visual field is normal in extent, or even wider than normal, or it may be only moderately reduced; but proceeding toward the right, the field both above and below the horizontal meridian contracts in a remarkable manner, and this for the reason that it represents the functional ability of the optical nervous apparatus, which has become fatigued during the examination.

Now allow the patient to rest for fifteen or twenty minutes, and then examine the visual field of the same eye under the same conditions, but with this exception, that the object used in the examination is moved along all the meridians in the opposite direction from that in which it was moved in the previous direction,—that is, in the direction indicated by the dotted-line arrows. In this way we obtain for each eye two visual fields, the boundaries of which intersect each other in the vertical meridian. The second field, indicated by the dotted lines, we will, for the sake of convenience, call the "counter-field." Observe now that the most contracted part of the counter-field, representing the functional activity of the fatigued retina, lies on the same side as the most expanded part of the visual field, and wholly within its boundaries.

The exterior boundary lines, the full lines in the left half, and the dotted lines in the right half, regarded as one

figure, represent the visual field of the rested or only slightly tired eye, while the inner lines, likewise combined to one figure, represent the visual field of the same individual at a time when the nervous part of his eye is nearly exhausted.

CASE I.—Fig. 1. Mrs. R.; delicate figure, thirty-four years old, married twelve years, menstruates regularly. Was formerly healthy. Some years ago passed through a severe attack of articular rheumatism. Two years later she had diphtheritis and abortion, followed by a return of the rheumatism. She dates her present troubles from that time. Complains of migraine now on the right and now on the left side; of terrible pain in the crown of her head and great tenderness of the scalp. Is very forgetful. Loses herself often in the midst of a sentence, and cannot proceed to express herself. Suffers from palpitation and anxiety. Spirits very changeful, generally depressed; is very moody, and weeps much. At times passes into an hypnotic condition, during which she stares into the corner vacantly and knows nothing. Has hallucinations; thinks she hears her name called, or children crying, or bells ringing. Often hears a roaring in her ears. Is much annoyed by noise and long conversation. Often experiences a bad smell, and has a continual bad taste in her mouth. Her tongue is clean. Has aversion to meat.

Has deep-seated pain in both eyes. Is dazzled greatly by light, especially by lamplight. Has a severe burning sensation in both eyes. Often sees before her eyes countless black specks, which disappear when she turns her head. It often seems to her as if there was a mist or smoke in the room. This symptom appears and disappears suddenly. When she tries to read or sew, the letters or work become confused, and finally disappear. Has often temporary diplopia. Suffers from intercostal neuralgia, and often has a pricking and itching sensation in the face. Often has numbness of the fingers and cramps in her arms and legs. Her legs go to sleep easily, and she often experiences the sensation of formication. Always feels tired, and complains of pain in the back. Cannot sleep at night, but tosses restlessly in bed. Often has the feeling as if her throat and bowels were choked up. Has much gurgling in the intestines and much thirst. At times passes a great deal of urine, and at other times very little. Examination of the viscera gave no particular clue to diagnosis. Examination

of the eyes showed in both hypermetropia $\frac{1}{40}$, normal acuity of vision and accommodation. Pupils normal in size and reaction. Fundus normal. In both eyes slight hyperæmia of the conjunctiva.

In this case the visual field of the right eye only was taken. During my attempt to take that of the other eye, the woman became so exhausted that I was obliged to desist.

The heavy full lines in this, as in all the following figures, show the visual field as obtained at the first trial. The heavy dotted lines show the counter-field taken by the method already described, after a rest of about fifteen or twenty minutes. The light dotted lines show the boundary of the normal visual field.

Case 2.—Fig. 2. Mrs. B., a slightly-built woman, thirty-one years of age. Experienced lead-poisoning when a girl; is always very tired and heavy in her legs, and suffers from dyspnœa on slight exertion. Formerly menstruated very irregularly; now menstruates regularly every three weeks, but for only a single day at each time. Blood flows from her mouth at night, but she does not know whether it is coughed up or vomited. She was married when twenty-three years old, and has four children. Inherits a neuropathic constitution. Her mind is very weak. Has palpitation and anxiety. Has terrible dreams. Formerly could not sleep well, but is now better in that respect. Complains often of dizziness. Is greatly affected by trifles, and of a very changeable disposition. Complains of occasional pains in her forehead, and of pressure in her head. The senses of taste and smell are normal, but she complains much of a roaring in her ears, and at times has hallucinations of hearing (hears children crying). Has an annoying sense of pressure in both eyeballs. Sees well, but after gazing steadily for a while at one place, every thing grows gray before her. A short time ago she had a hallucination of sight, thinking she saw a black coffin standing in the room. Often has photopsiæ in the form of small birds flying before her eyes. She is not dazzled by light, but she cannot use her eyes for any continuous work. Sometimes sees double, and suffers often from blepharospasm. Occasionally feels a numbness in her legs and hands. Sometimes has attacks of cramp, with trembling of

the limbs, groaning, and a semi-unconscious condition. Fugitive pains in shoulders and arms. At times pain in left ovary. Has pains in her loins and along the whole spinal column. Has a feeling as if her legs were broken below the knees. Has much pain in the abdomen,—colic and bloating. Her feet are always cold. She becomes often hot and then cold in her body. Drinks and urinates much. Has a variable appetite, at times ravenous, and again no desire for food.

She has in both eyes slight hypermetropia, normal accommodation, and acuity of vision. The pupils are remarkably large, but show prompt reaction. The appearances observed on ophthalmoscopic examination are normal. There is slight insufficiency of the internal recti muscles. During the attempt to map out the visual field, the test-object often disappeared in its passage along a meridian, while the fixation-object appears now large and now small, now nearer and now farther; often it entirely disappears. These anomalies are observed in both eyes.

Case 3.—Fig. 3. Miss Th., seventeen years old. Family history good; has not yet menstruated. A weak, anæmic girl. For past seven years has suffered from chorea, and is said to have formerly had nystagmus. Mind weak, disposition variable, cries easily, is troubled by trifles, is anxious and fearful. Evenings she is much excited and cannot sleep. Complains of frontal headache, and of a beating in her temples. Always has cold hands and feet. Changes color easily. Complains much of pain in her stomach and of loud belching. Has little thirst and very variable appetite. Has various idiosyncrasies. Is liable to drop objects out of her hands, and has a feeling as if her legs were broken. Her whole body trembles with chorea. When reading or sewing, "all seems to run together." She often sees every thing as through a gray veil. This condition lasts generally for about ten or fifteen minutes and then suddenly passes away. She sometimes sees double. No anomalies of the muscles of the eye are to be observed. The pupils are wide, but are alike and react promptly.

Vision is not quite normal, and varies between $\frac{20}{30}$ and $\frac{20}{40}$. She has slight hypermetropia. While mapping the visual field the test-object often disappears in the neighborhood of the fixation-object, which latter also sometimes disappears, leaving for certain meridians a central scotoma. The color-sense is normal. The visual field of the right eye shows the same anomalies as that of the left.

CASE 4.—Fig. 4. Miss P., apparently a strong woman, æt. twenty-three, two years betrothed. Was often sick when a child. When seven years old had scarlet-fever, and corneal ulcer on left eye which resulted in leucoma adherens. Menstruated at age of seventeen, at first irregular, and afterward regularly. For past year she has complained of the following troubles. Without any apparent cause she often experiences great depression of spirits and shows great variations of temper. Has headache nearly every day, and a feeling of pressure on the crown and of knocking and hammering in her temples. In spite of her robust appearance she has a great deal of backache, can endure no continuous labor, and feels as if her legs would break. Often has palpitation, and is out of breath when she goes up-stairs. At times feels pressure and pain in the stomach. Once coughed up blood. Is always cold. Left ovary very painful under pressure. She cannot sleep when she goes to bed, and wakes in the morning with a sense of exhaustion. Has terrible dreams, and often cries out in her sleep. Her sense of taste is often wanting. She is so dazzled by light that she often has to sit during an entire evening in a dark room. There are often times when every thing appears to her as if seen through mist or smoke. These attacks after lasting about half an hour pass away suddenly. She has normal acuity of vision in the right eye; in left eye leucoma adherens. Pupils large and thin, reaction normal. Ophthalmoscopic appearances normal. The visual field of the left eye could not be taken on account of the presence of the leucoma.

CASE 5.—Fig. 5. Miss H., æt. twenty-two; strongly built. Has passed through much mental distress, her family having lost property, and she being compelled to work for a living. Is betrothed, but worries herself and her lover by her jealousy. Menstruates irregularly; much inclined to weep. Of a very variable disposition and irritable. Complains much of palpitation and sleeplessness. Her sleep is interrupted by frightful dreams. Has a boring pain in her crown and a beating in her temples. Globus hystericus. Has once vomited blood. Complains much of pain in her abdomen. Tires very easily of work, feels as if bruised in the limbs, and often has cramps in her hands and legs. Feels alternately cold and hot, and always has cold feet. She often has the feeling as if her eyes were forcibly turned, and is very much dazzled by lamplight. Often has shadows before her eyes, and a sensation as if the room was full of smoke. Has often had tem-

porary diplopia. Upon examination the ocular muscles appear normal. Has slight hypermetropia, and normal vision and accommodation. During the examination with the perimeter central scotoma often appeared, and the test-object would momentarily disappear while passing along a given meridian.

CASE 6.—Fig. 6. Miss Von H., strong frame, æt. twenty-six. Had severe typhoid fever when nine years old. Has menstruated regularly since fifteen years old. Her present troubles have existed for four or five years. They are said to have been caused by a terrible fright, caused by a hallucination of sight which she experienced. Since then her mind has been confused and she has been unable to control her thoughts. Mental exercise is very difficult for her. She complains often of migraine and of a boring pain in the left side of her head. Temper very variable. Easily irritated, and often filled with anxious forebodings. Complains of a feeling of throbbing in the temples, and of occipital neuralgia. Often has hallucinations of sight, sees animals and landscapes, and has a constant humming and roaring in her ears. Often imagines that she hears the ringing of bells. Varies between great and very little thirst. Her appetite also is variable, but she has a constant disgust for meat. Complains of dyspnœa upon going up-stairs, of palpitation, and of abdominal pains. Vision, size and reaction of the pupils, and color-sense all normal. Slight hypermetropia and insufficiency of the internal recti muscles. Ophthalmoscopic appearances normal. The visual field of the right eye shows analogous peculiarities.

CASE 7.—Fig. 7. Mrs. N., forty-seven years old, married at twenty-nine. Had typhoid fever at eighteen, but recovered and felt perfectly well and sound. At birth of her first child she suffered a great rupture of the perineum, which was followed by prolapsus uteri. Her troubles date from that time. Her menses ceased one year ago. At the times when they should appear all her bad symptoms increase, and she feels very dizzy. She feels weak and tired; sleeps well; often depressed in spirits; easily irritated; has become very forgetful, and easily becomes dizzy; often has headache, beating in the temples, and humming in her ears. Sometimes loses her sense of taste. Complains much of pain in the back, mostly when lying down. Has also shooting pains in her shoulders. Right leg weaker than the left, and she often has a feeling of numbness in it.

Appetite poor; little thirst. Often sees every thing as if through

a blue veil, and this condition will often pass away suddenly as if by a stroke. Is much dazzled by lamplight, and when at evening the lighted lamp is set upon the table she experiences severe pain in the head and a hammering in her temples. Her troubles increase when she tries to read. The letters seem to change their size, sometimes seeming large and sometimes small, and then disappearing entirely. When looking intently at any one with whom she is speaking, his features will disappear, to her great annoyance. Has never had diplopia.

Myopia—$\frac{1}{7}$ in both eyes. Vision, $\frac{20}{40}$. Ophthalmoscopically, an atrophic ring can be seen surrounding the optic disc. The pupils are equal in size and of normal reaction. After a colporhaphia posterior all her bad symptoms, both general and special, as affecting her eyes, disappeared.

Case 8.—Fig. 8. Miss I., sixty years old, inherits neurotic troubles. Her mother was an epileptic. As a child she was always chlorotic. Menstruated at fifteen, always irregularly. Her menses ceased six years ago, since which time her nervous troubles have increased. Was formerly very forgetful and abstracted and now finds it very difficult to collect her thoughts. Much inclined to weep; very irritable and generally depressed in spirits. Rests poorly, not being able to sleep until near morning, and when in bed she feels such an itching and burning of the skin that she cannot lie quiet. Upon waking she feels tired, and as if she had been pounded. Complains much of pressure on her head, and of occipital neuralgia. As a girl, she often had hallucinations of sight, saw faces and marching soldiers, and clouds often seemed to float before her eyes. When she tries to read or sew, every thing swims before her eyes, and she experiences a straining of the eyes which is only slightly relieved by convex glasses. Light dazzles her much, and the reflex from her spectacles annoys her. Color-sense is normal. There is slight insufficiency of the internal recti muscles. She imagines often that she hears her name called, and has an almost constant ringing in her ears. Objects which have really not changed for the worse often seem to her to have a sickening smell. She often loses the sense of taste. Easily becomes hoarse. Is often unable to express herself; words failing her. Complains much of palpitation and anxiety. Formerly had much pain in her abdomen, twitching of the arms, and burning of the skin. Suffers from intercostal neuralgia, and the feeling of heaviness and breaking in her legs. Often has trembling of the extrem-

ities. Much backache, thirst, and variability of the appetite. Obliged to urinate fully. Her feet often swell. Frequent change of color, and change of feeling from warm to cold. Pain in the inguinal region. Numbness in fingers and legs and formication. Slight hypermetropia and presbyopia. Vision = $\frac{20}{30}$. Ophthalmoscopic appearance normal. The visual field of the right eye was not taken.

Case 9.—Fig. 9. Minna J., seventeen years old; thick-set; healthy appearance. Menstruated once in her sixteenth year, but never since that time. Until a short time ago was entirely healthy, but complains now of palpitation and anxiety, particularly at night, so that she often starts up affrighted in bed. Cannot sleep well. Feels tired when she rises in the morning. Has frightful dreams. Is irritable and depressed in spirits. Often imagines that she hears her name called. Is very much disturbed by noise, and cannot endure loud conversation. At times hears poorly with her left ear. Has often a bitter taste in her mouth. Often feels as if a dark veil was hung before her eyes, which condition will last for about a quarter of an hour. After she has read a little while the letters swim before her eyes. Often has hallucinations of sight; thinks she sees large animals and men. Has moderate hypermetropia, and vision $\frac{20}{40}$. At a time when her general health was better, her vision was found to be $\frac{20}{30}$. Pupils large, but of prompt reaction. Ophthalmoscopic appearances and color-sense normal. A short time ago, complained of monocular diplopia. When she strains her eyes they weep as if she had been crying. Complains much of a beating in her temples and of headache. Often has spasmodic twitching of the eyelids and of the lips. Intercostal neuralgia on right side. Left ovary very tender under pressure. Backache; pulsation in abdomen. Complains much of fatigue. Her feet and hands easily become numb. Her legs go to sleep, and her right arm is often powerless. She often has clonic cramp in her left arm and hand. At times has pain in the abdomen, shooting from the back to the inguinal fold. Patellar reflex exaggerated, so that upon striking upon it the twitchings extend over the whole body. Changeable appetite. The visual field of the right eye shows analogous relations.

Case 10.—Fig. 10. Anna B., fourteen years old, menstruated a short time ago. A scrofulous girl, with episcleritis. For last few weeks has complained of a pricking in her eyes, and weeping when she uses them. At first she can read well, but after she has read

a few lines the letters seem to swim and disappear. After turning from the book and resting her eyes she is again able to read a few lines. Her vision changes greatly. Some days she can see much better than others. Often, for hours, every thing seems as if seen through a gray veil. She is much dazzled by lamplight. Often has temporary diplopia without there being any observable anomalies on the part of the ocular muscles. Ophthalmoscopic appearances normal. Pupils of equal size and have normal reaction. She has hypermetropia, $\frac{1}{20}$; but in spite of convex glasses all her troubles continue. At the time of examination her vision was normal. She has attacks of blepharospasm. Has almost continual headache, and at times palpitation of the heart, and a feeling of anxiety. She is very peevish and inclined to cry. The visual field of the left eye was not taken.

Case 11.—Fig. 11. Mr. G., upholsterer; an anxious, haggard-looking man. Complains of mental weakness, inability to remember names, disinclination to work or to engage in any of the employments which formerly interested him. Broods much over his condition, has inherited a neuropathic disposition, is easily irritated, and can endure no contradiction. Is generally depressed, but sometimes excited, at times without any adequate cause. He has no interest in his business, but is inclined to dream of better times. Complains of involuntary emissions and of the annoyance he feels that this infirmity is manifested to others by the appearance of his countenance. He feels tired and sleepy in the morning and complains much of backache. His arms and legs are often lame. Has a numbness in the hollow of his soles. Feels weak in his calves. Has a dull expression of the eyes. After having had an emission at night his eyelids feel as heavy as lead in the morning. Feels better generally in the evenings. Complains of a pricking, burning feeling in the eyes, of pain and a confused feeling in his head. Appetite changeful. Very little thirst. Has read much in medical books, and imagines all kinds of absurdities in reference to his condition.

Has in both eyes hypermetropia of $\frac{1}{20}$. Normal vision. Ophthalmoscopic examination reveals hyperæmia of the optic disc. Slight insufficiency of the internal recti muscles and slight conjunctival catarrh. Cannot wear the glasses which correct his hypermetropia. He sees better through them, but the reflex from the glasses dazzles him, and he cannot endure the slight pressure which they cause upon his nose and temples. The visual field of the right eye shows analogous relations.

Case 12.—Fig. 12. Mr. P., twenty-four years old, merchant; of weak, anæmic appearance; inherits a neuropathic constitution. His father was born with hydrocephalus, was operated on by puncture; later became insane and died of apoplexy. His mother is said to have been very nervous. The patient shows much intelligence, and at times can carry on his business with great ability, but he often becomes so exhausted that he must lie still for hours, and at such times it is impossible for him to collect his thoughts. Has a very variable disposition; is generally depressed, but sometimes excited. Has times of abstraction when he hears nothing that is said to him although he sees that some one is speaking to him. Experiences various hallucinations. A short time ago he ran along an alley believing that he was followed. Has roaring in his ears, hears his name called, sees shadows and small gliding animals and persons, which appear to him in his office. Is much dazzled by light, and sees a red cloud of light when his eyes are closed. His pupils are of different size and react promptly. Ophthalmoscopic appearances and color-sense normal. Vision normal with slight hypermetropia. There is slight insufficiency of the interni muscles. Slight conjunctival catarrh and painful burning feeling in the conjunctiva. This condition and the red cloud which he sees when his eyes are closed often give him the sensation as if his eyes were on fire. Amaurosis partialis fugax has recently appeared. He has also hallucinations of taste and smell and a number of other abnormal symptoms. The use of wine diminishes all these bad symptoms. The examination with the perimeter revealed the following conditions: torpidity of the retina; blepharospasmus clonicus, followed by cramps of the muscles of the face, and finally by general spasms. The visual field of the right eye shows analogous relations.

Case 13.—Fig. 13. Miss S., governess, eighteen years old, of blooming appearance. Said to have been a weak child. Menstruated since her thirteenth year, at first regularly. Had diphtheritis two years ago, and since then has menstruated irregularly and been very nervous. Since that time she has noticed at the time of her menses a peculiar clouding of the eyes and inability to see well. For some months past her sight in general has not been so good as formerly, and it is only in a very bright light that she can see distinctly. She cannot, however, endure bright lamplight, and has to sit evenings in

a dark room. When she passes from darkness into the light she is attacked with dizziness. Her temper is very variable, and she cries easily. She often has attacks of migraine, palpitation of the heart, anxiety; and shortness of breath upon going up-stairs. She has much pain in her abdomen and a feeling of constriction about her waist. Has frequent twitching of the under lid. Taste and smell normal. Feels always tired. Sleeps poorly and complains of backache. The pupils are very wide, but react promptly to light. There is hypermetropia, $\frac{1}{40}$; normal vision, but the degree of vision is subject to frequent changes. The visual field of the left eye shows analogous relations and limitations.

Case 14.—Fig. 14. Mrs. S., twenty-four years old. Has very poor vision, about $\frac{1}{100}$. Pupils alike and react promptly. She recognizes all colors except red, which she says looks brown. Light pains and dazzles her. Has slight blepharospasmus clonicus. The ophthalmoscope reveals atrophy of the pigment layer throughout the entire fundus and a moderate degree of hypermetropia. Her vision varies with the state of her health. Her sight failed gradually. Objects often seem to her as if seen through a cloud. During her pregnancies this capricious patient has always been very hysterical. The right visual field is still more contracted than the left. In spite of her contracted visual fields and poor vision her manner and movements give no hint of the existence of such a high degree of amblyopia.

Case 15.—Fig. 15. Miss C., twenty-three years old, companion of a lady who is an epileptic and insane. She once had a hemorrhage from the mouth, but whether she vomited or coughed the blood up is uncertain. In the winter of 1880–81 she had for a few days a continuous frontal headache, palpitation of the heart, hyperæsthesia of the scalp, and clavus hystericus. Slept well. In the beginning of December (probably in 1881) she had frequent attacks of headache with free intervals, loss of appetite, and irritable temper. Became very sensitive to smells. Latterly the headache has increased and her vision has become at times clouded; she feels tired, and she suffers from alternate chills and heat. Her vision began to fail markedly three weeks ago. Jan. 10, 1882, she began to feel sick in the mornings when she got up; had a burning sensation in her eyes. In the evenings she was accustomed to play at cards. She noticed that every thing looked cloudy to her, and her visual field became so contracted that it seemed as if she saw every thing through

a horizontal slit. For some time objects have looked to her as if seen through a gray-blue veil. Greatly to her annoyance she has been wearing convex glasses which had been prescribed by a physician on account of her slight hypermetropia, but all her troubles have increased. With slight hypermetropia her vision varies from $\frac{20}{25}$ to $\frac{20}{30}$. Color-sense, ophthalmoscopic appearances, and behavior of pupils normal. Upon one occasion during examination with the perimeter vision, in consequence of fatigue, sank to $\frac{20}{70}$. The visual field of the left eye is less contracted.

Case 16.—Fig. 16. Miss B., a delicate young lady who has always been sick. Cannot get to sleep till near morning. Complains of great variation in her spirits; is generally irritable and peevish; subject to palpitation, throbbing in the temples, dyspnœa, backache, pains in her legs and head; always tired; wakes in the morning feeling quite worn out. Menstruation irregular. She often experiences great anxiety, and her color changes frequently from red to white. She is so blinded by light that during the evening she cannot sit in the family room. She cannot endure loud conversation nor the noise of passing wagons. Has myopia of $\frac{1}{6}$ to $\frac{1}{7}$, with vision $\frac{20}{30}$. Ophthalmoscopic appearances normal. Pupils very large, but alike and of prompt reaction. Slight insufficiency of the interni. Cannot wear spectacles to correct her myopia because she is so annoyed by the reflex from the glasses, and because the cutting of the frame upon her nose and temples causes an unendurable pain. The visual field of the right eye shows analogous though less pronounced relations.

Case 17.—Fig. 17. Mrs. V., a strong and voluptuous-looking woman. Of neuropathic heredity, and during her youth affected with scrofulous disease of the bones. To the time of puberty was a somnambulist. Suffers from uterine disease. Complains that she is constantly in a kind of dreamy condition; cannot retain her thoughts; often loses herself in the midst of a sentence. Of an irritable and peevish temperament. The number of her complaints and symptoms is enormous, indicating a decided case of hysteria. Complains of poor vision and inability to read or sew. Has astigmatism. Vision, $\frac{20}{40}$. After examination with the perimeter, her vision sank to $\frac{20}{70}$. Sees much better through proper spectacles, but cannot wear them because the reflex and the pressure of the frames annoy her so.

Case 18.—Fig. 18. Mr. D., has indulged in great sexual ex-

cesses. Is thirty-four years old, and still practises masturbation. Is weakminded, has an uncertain, halting gait, a twitching of the eyeballs, difficult speech, palpitation, and fearful anxiety. Slight myopia. Insufficiency of interni. Vision $\frac{8}{10}$. Pupils normal. The contour of the retinal vessels is remarkably clear and broad. Has headache, abnormal sensations of smell; is very irritable and depressed, and has innumerable nervous symptoms. Is much dazzled by light.

Case 19.—Fig. 19. Miss K., fifteen years old, appears strong and rosy. Has poor, brittle teeth. A year ago had a fall upon back of head, which caused long-continued unconsciousness. Since then all manner of troubles. Often complains of headache after mental exertion. Has at such times the feeling as if a plate lay upon her head. At various times has had transitory diplopia. Complains of pain in eyes. Occasionally has macropsia and micropsia when reading. Objects often appear nearer or farther away than they really are. Has hallucinations of hearing. Hears her name called. These imagined sounds are very loud, and appear to come generally from behind her and to reproach her. It often seems as if a veil were hung before her eyes, and then this appearance vanishes suddenly. Sometimes she sees much worse than at others. Formerly was troubled by photopsies in form of showers of sparks. There are often times when she can see only the particular object upon which her eyes are fixed, while all the peripheral visual field seems obscured by a cloud. There is hyperæsthesia of taste and smell. Often her hearing becomes poor, and at other times it becomes abnormally acute. At times, too, she has good vision. Often every thing tastes badly to her. At times she has slight temporary ptosis. Pupils often unlike in size, but react normally to light. Although a very intelligent girl, it is at times impossible for her to collect her thoughts. Has palpitation, anxiety, restlessness, and variable temper. Has a feeling of dryness in the throat, and of pulsations in the abdomen. Is tired, and has a feeling of numbness in her arms and legs. Sleeps poorly. Has slight myopia and normal acuity of vision. For some weeks has had attacks of amaurosis partialis fugax of about ten minutes' duration. Associated with these attacks is complete left-side hemianopsia, with zigzag flickerings of light on the margin of the visual field. The left halves of the visual fields are obscured during these attacks, and there occurs at the same time a weakness and a disturbance of

sensibility of the entire left half of the body. This condition ends in a severe headache. There is quite marked hyperæmia of the optic disc. Slight insufficiency of the interni. The portion of both visual fields which is cross-hatched in each figure shows the existence of an annular scotoma. It can be seen that during the second examination of the same eye an annular scotoma appeared upon the other half of the visual field, occupying a part of the region of the first one. The scotoma with its concavity turned to the right, indicated by black cross-hatchings, belongs to the first-taken visual field, which is indicated by the full black lines; the one with its concavity turned toward the left, indicated by broken line cross-hatching, belongs to the visual field indicated by the broken lines. The visual field of the left eye shows analogous changes, including the annular scotoma.

CASE 20.—Fig. 20. Anna T., a strong woman, thirty years old. Menstruated at seventeen years. Her periods were always regular, but were accompanied by considerable pain. Vision has been poor since childhood. Often has hallucinations of sight; often sees heads and deformed faces. Has distressing dreams; cries easily; has a changeful disposition, but is generally depressed, as is indicated by her countenance. When she tries to read or sew every thing swims before her eyes and disappears. Often feels as if the room were filled with smoke; is dazed by light; has had nystagmus since youth. Suffers much from headache; her sense of smell sometimes entirely fails; has a continual throbbing in her temples; much backache and frequent lameness of her legs; her feet swell easily; has palpitation; loses breath in going up-stairs; easily becomes cold.

Ophthalmoscopic appearances normal; no anomaly of refraction. Vision in both eyes $\frac{20}{40}$. Pupils normal. The visual field of the left eye was not examined.

CASE 21.—Fig. 21. Mrs. P., thirty-two years old; of strong, blooming appearance. Faints very easily; much depressed in spirits; sleeps poorly; always tired; has palpitation and anxiety; pain in side; occipital neuralgia; throbbing in temples; numbness in right leg and hand; her extremities often powerless. Since last confinement has had prolapsus uteri; has a slight degree of hypermetropia, with vision $\frac{20}{40}$. Has hyperæmia of optic disc; hallucinations of sight; is much dazzled by light, and has slight insufficiency of the interni. Pupils normal. Complains of roaring in her ears; is forgetful and absent-minded; has hyper-

æsthetic condition of taste and smell. The visual field of the left eye was not examined.

CASE 22.—Fig. 22. Miss B. T., twenty-three years old; was healthy until after appearance of menses in her seventeenth year. They came on at first every fortnight, and lasted for eight days. Then they did not appear for a whole year. She is now irregular; before the appearance of her sickness she has feelings as if she were enveloped by a cloud, and has hallucinations of sight. She is now much dazzled by light; becomes dizzy and has headache as soon as she is dazzled. She often suffers from amaurosis partialis fugax, with defect of the left half of the visual field, with subsequent migraine and vomiting. Often has temporary diplopia. Cannot work continuously, as the object looked at often disappears from her sight. She sees stars and balls, which seem to elongate before her eyes. She sheds tears without any mental disturbance; complains of burning in her eyes. Conjunctivæ often hyperæmic; sometimes has ptosis. Often thinks she sees objects and figures whisk by her. Has hypermetropia, $\frac{1}{24}$, in both eyes; normal vision and accommodation, blepharospasmus clonicus, macropsia, and micropsia. Sight of bright colors causes headache. Cannot sleep when she retires; wakes in the morning feeling as if she had been beaten. Has most of the symptoms described in the previous cases. The visual field of the right eye shows analogous relations.

CASE 23.—Henrietta P., thirteen years old; not yet menstruated. Complains that she has lately had great trouble with her eyes when she tries to read or sew; is much dazzled by light, and has a pricking in her eyes. Has frequent hallucinations of sight,—sometimes diplopia, macropsia, and micropsia. When she reads the letters all run together. Reaction of pupils normal, but the right one is larger than the left. Color-sense normal. Has hypermetropia; normal acuity of vision. Slight insufficiency of interni. There is slight capillary hyperæmia of the optic disc. Has backache, pain and pressure in the head; variation in acuteness of hearing, and hallucinations of hearing. Voices seem to come from behind her. Often loses sense of smell; has anxiety; sleeps well. Has frequent pain in abdomen and under her knees. The visual field resembles that of the foregoing case—Fig. 22. The contraction of the field still remained after three weeks of electrical and dietetic treatment, during which all her other symptoms improved.

Case 24.—Miss D. F., thirty-four years old; healthy appearance. Complains of left-side migraine and floating specks in her eyes, followed by vomiting. Has hallucinations of sight, macropsia, and micropsia. Is much dazzled by light; has a feeling as if her eyeball were turned around in its socket. Sometimes has tears in her eyes; frequent attacks of cloudy vision, but no photopsies. Cannot work continuously, and often sees double. Pupils unlike, but react promptly to light. Ophthalmoscopic appearances normal. Complains of pressure on the skull and inability to think. Often stops speaking in midst of a sentence because she has forgotten what she wished to say, although naturally talkative. Sleeps poorly. Is often in high spirits, and then again depressed,—almost to the verge of suicide. Has hallucinations, and exaggerated acuity of hearing. At times every thing smells and tastes bad to her. Is often anxious; has palpitation, and sometimes red patches on her face. Complains of a constriction in the throat; suffers from hypnotism and apathy. Is alternately hot and cold. Upon going to bed she experiences such a pricking in her skin that she has to spring up. Wakes exhausted in the morning; has backache and intercostal neuralgia. Was once formerly treated for an hysterical neurosis of the hip-joint; complains now of pain in the joints of her hands and knees. The visual field is like that in Fig. 9.

If it is true, as Rudolf Arndt asserts (*l. c.*), that the sum of all the morbid symptoms in neurasthenia can be subordinated into the one fundamental phenomenon, of an increased excitability of the nervous system, with a tendency to rapid fatigue, particularly of the muscular spheres, followed possibly by convulsions in the muscles and corresponding processes in the glands (transition toward hysteria and epilepsy), then we can easily explain the clinical symptoms of the so-called hyperæsthesia, or anæsthesia, of the retina.[1] For

[1] I will venture to report, in brief, the ocular symptoms of some cases that I have seen since beginning this paper.

(*a*) Mrs. A., æt. thirty; has lost children from convulsions. Is dazzled by light, has attacks of misty vision, slight amblyopia, periodical left-sided hemianopsia with flickering photopsies, and a diminution of sensibility on the entire left side. Hallucinations of vision; sees cats, and has other typical nervous symptoms. Ophthalmoscopic condition normal, pupils normal, visual field resembles that shown in Fig. 5.

(*b*) Child, æt. twelve; dazzled by light, *Hm.* and slight amblyopia. Pressure in the eyes, and cannot work very long. Ophthalmoscopic condition normal; constitutional nervous symptoms.

under this symptom, which might more appropriately be called neurasthenic asthenopia, we understand the local appearance of a constitutional nervous affection, the expression of which in the eye is introduced in the form of increased sensibility, and greater irritability of the entire optical nervous apparatus. Amongst the symptoms which cause the greatest annoyance to the patient are the appearance of hallucinations of vision, visual illusions, photopsies, dazzling of the eyes from any bright light, and, on the part of the trigeminus, pricking, boring, and burning pains, together with a feeling of pressure and sensations of rotation in the eyes and their neighborhood. As a result of this hyperæsthetic condition, we immediately discover a greater tendency to weariness, or even conditions of partial paresis, which on the part of the nerves of special sense express themselves objectively in that peculiar form of contraction of the field of vision, or by transitory diminution in the acuteness of central vision, by the appearance of evanescent central and ring scotomata, marked also by too rapid disappearance of any given fixed objects, by obscurations of vision and lack of ability to read or to use the eyes at close work for any length of time; and, finally, distinguished, on the part of the accommodation and the extrinsic muscles of the eye, by micropsia, insufficiency of the internal recti, diplopia, and ptosis. These symptoms, moreover, are frequently accompanied with secretory and vaso-motor disturbances, inasmuch as without any particular external influence such patients as these occasionally complain of tears, transitory injection of the conjunctiva and ciliary vessels, while with the ophthalmoscope we can generally discover a hyperæmic condition of the optic papilla.

(*c*) Mrs. B., æt. thirty-one; slight amblyopia, dazzled by light, hallucinations of vision, photopsies, insufficiency of the int. recti, numerous nervous symptoms, disease of the uterus. Normal ophthalmoscopic condition. Visual field as in Fig. 10.

(*d*) Miss C., one of the *demi-monde*, æt. twenty-six; dazzling hallucinations of vision, sees vanishing shadows, photopsies, macropsia and micropsia, sudden obscurations of the eyes, pain in the eyes, lachrymation, numerous nervous symptoms, disease of the uterus. Visual field as in Fig. 5; astig. myopic.; S = 1. Ophthalmoscopic condition normal, pupils normal.

(*e*) Miss F., æt. twenty-three; amblyopia, hallucinations of vision, misty vision, photopsies, typical nervous symptoms, uterine disease, hyperæmia of the optic papilla. F. as in Fig. 4.

We occasionally also observe an increased, morbid reflex action toward the sensitive and motor spheres, expressing itself by violent headache whenever the light is more dazzling than usual, by an increased burning sensation and lachrymation of the eyes after any slight exertion, by clonic blepharospasm, by spasm of accommodation with macropsia, by fibrillary twitching of the lids and muscles of the eyes, and finally by transitory diplopia.

There is hardly any need of remarking that it is not necessary for every one of these troublesome symptoms to manifest itself either in equal intensity or at the same time in one and the same patient, but it is rare that we come across a neurasthenic patient who has not, in the course of time and by the occurrence of one or another local annoyance, had occasion to complain of all of the symptoms which we have just described in detail.

The expression of neurasthenic eyes is quite peculiar: they appear to exhibit an insuperable tendency to redden easily during conversation, and are generally quite brilliant. The pupils are occasionally widely dilated, and the conjunctiva slightly injected. If the eye becomes wearied by the examination, it assumes that expression of the "breaking" eye, so difficult to describe, with relaxed and dependent upper lid. Most of the patients, even the restless ones, fix any given object sharply, but they show peculiar associated movements of the eyeballs, restlessly fixing first the left eye and then the right, of the examining surgeon. Many, also, when moving their eyes voluntarily, exhibit those quivering motions of the eyeballs which remind us of ataxia.[1]

True to the principle of classification, which is based upon the previously mentioned fundamental symptoms, we shall now proceed to show, *that the so-called anæsthesia of the retina, as an expression of neurasthenic disorders, forms but one of similar links in the chain of equally valuable nervous symptoms on the part of other organs.*

We shall, therefore, first direct our attention to the

[1] Witkowski: *Arch. f. Psych. und Nerven.*, 1879, p. 443, and *Michel's Jahresbericht f. Oph.*, 1879, p. 416.

conditions of increased excitability and hyperæsthesia in other organs, in comparison with analogous and associated symptoms on the part of the eyes.

The easily irritated, moody, passionate, and excitable condition exhibited by these patients is too well known to merit a detailed description, and it is to those around them only too frequently a source of great anxiety and unjust reproaches. Almost all of them complain of difficulty in obtaining sleep; many on the contrary fall easily to sleep, but soon awaken and then seek in vain through the livelong night for the desired slumber. Others, again, cannot for a long time get to sleep, for when they have gone to bed an innumerable host of fancies rushes down like a flood upon them as they seek for rest, and still later in the form of awful and terrible dreams deprives them of the slight refreshment of sleep when at last it is tardily obtained.

The most frequent complaints of symptoms on the part of the spheres of sense are of humming and ringing in the ears. Many complain also of hallucinations of hearing: they hear children crying, they hear their own name called, and are extremely sensitive to loud talking and sometimes to every possible quality of noise. Hallucinations and hyperæsthesia of smell and taste are, moreover, by no means infrequent; in a few patients something smelt "so sharp that it felt almost unendurable," or it excited the most violent sort of headache.

The complaints of irritative conditions in the sensitive spheres are legion: the feeling of infinite weariness and depression, headaches, clavus hystericus, pressure on the head, migraine, supra-orbital neuralgia, occipital neuralgia, pain in the eyes, toothache, dryness in the throat, constriction around the neck, hammering in the temples, palpitation of the heart, pulsations in the body, pain in the body, intercostal neuralgia, pain in the back, formication, itching and burning of the skin, which hinders many patients from falling asleep, or increases the difficulty already mentioned of falling to sleep or from remaining for a long time in a condition of restful slumber; and finally a feeling of cold in one set of extremities and of simultaneous heat in the other.

The most prominent symptoms from the motor spheres are the restlessness and frequent change in the position and arrangement of the patients' limbs, and in many of the more intelligent a persistent and rapid alternation in the fixation of the eyes of the examining physician, especially during conditions of mental agitation.

It might, perhaps, be going too far to attribute too much importance to fifteen exhibitions of visual hallucinations in thirty patients. For they do not over frequently revisit the sufferers, and are generally looked at from the comic side. It was in two of my cases only that the patients were so terrified that one of them endeavored to fly from his supposed pursuer, while the other thought that her whole condition must be dependent upon that one hallucination. A lady whom I treated for an affection of the lachrymal apparatus, and who exhibited all of the previously mentioned characteristic peculiarities of neurasthenic asthenopia, frequently became the subject of hallucinations of sight and visual illusions during the introduction of the probe, imagining that she saw the office full of blood or the floor covered with flowers, while occasionally the bottles on the table and various objects upon the writing-desk would appear like bunches of roses. The photopsies are almost always perceived as glittering clumps of snow, shining surfaces, occasionally as colored globes and points. Some, moreover, assert that the vivid photopsies disappeared the moment that their eyes or head were in the least rotated from the position first assumed. Several patients have told me that whilst reading, the letters would look green and the paper of a different color; and one assured me that objects frequently appeared to him as if entirely covered with a reddish shimmer. The most constant symptom of all, the dazzling of the eyes by even a moderate amount of light, is probably augmented by the remarkably wide pupils.

Beard has asserted that the slight hyperæmia of the optic papilla,[1] observed by many authors in cases of anæsthesia of the retina, is a symptom of some vaso-motor disturbance.

[1] Mooren: These ARCHIVES, vol. x, page 281; *Nagel's Jahresbericht*, 1874, page 440; *Ibid.*, 1878, page 343; *Ibid.*, 1876, page 516.

This condition was rarely well marked in our cases, although in many it was easy to see that the optic papillæ were more abundantly supplied with blood than usual. In five of my cases I discovered what I regarded as additional symptoms of a vaso-motor disturbance, viz.: the appearance of a transient partial amaurosis,[1] with lateral defect of the field of vision and motor or sensitive disturbances of the same side of the body, accompanied with migraine and followed by vomiting. These anomalous processes in the circulatory apparatus appear under still other shapes in the form of easily provoked blushing, in an inclination to œdema mostly of the feet, by a peculiar glitter of the eye which is very piercing in many patients, and by slight injection of the conjunctiva just like that which is observed in people who have kept awake all night, in which case the indefinable complaint of burning in the eyes is moreover increased. One lady whom I had occasion to treat would often exhibit, without any assignable cause, so pronounced a chemosis of the conjunctiva of one eye that it would look as if the eye were seriously implicated, and yet in a few hours the œdema would have disappeared entirely. Another patient had frequent attacks of œdema of the face, usually of the right side, and to so excessive an amount that the eyelids would be totally closed by the swelling. In the course of twelve hours, however, this symptom would vanish. The urine was perfectly free from albumen.

The feet of a nervous boy, a patient of mine, would frequently puff up, while at other times, with equal frequency, he would suffer from œdema of the lower lip persisting for several hours. Occasionally his eyelids would be œdematously enlarged. He belonged to a family that had been terribly afflicted with neuropathy, although there was no trace of albumen in the urine nor any demonstrable alteration in the heart.

A man with slight hyperæmia of the conjunctiva complained of burning in his eyes and of a frequent red mist

[1] Latham: On Teichopsia, a form of transient half-blindness; its relation to nervous or sick headaches, etc. *Med. Times and Gaz.*, vol. xliv, page 359; *Nagel's Jahresb.*, 1872, page 370.

before them, and said, no doubt exaggeratively, that his eyes felt as if they were all on fire.

It is perhaps possible that the occasional difference in the size of the pupils may be explained by vaso-motor disturbances.[1]

The secretory spheres exhibit symptoms which are more or less analogous to those offered by the sensitive and motor spheres. Amongst the psychical reflexes, we meet with the extraordinarily easy inclination of these patients to weep, as well as their complaint of tears upon slight variations in temperature and after moderate exertion of the eyes, although neither a catarrhal condition of the conjunctiva nor any hindrance to the passage of the tears is present. Amongst the associated conditions in these spheres we are to remember the increased secretion of perspiration and urine as well as the frequent nocturnal pollutions. Amongst other curiosities in this respect we may quote the following: One of my patients, a maiden lady of forty-five, complained that for many years, without the presence of any noticeable alteration in her left breast, it had at times secreted a large amount of milk.

The inclination to rapid weariness expresses itself in the sensorium by lack of mental energy and perseverance, by mental exhaustion, forgetfulness, absent-mindedness, and a feeling of depression. We frequently see the loquacity of the patient cut short in an instant, as it were; the thread of ideas is lost, and the supply of words, for the time being, utterly exhausted. In the case of other nerves of sense we hear complaints of occasional diminution or entire loss of the sense of smell, diminution or loss of hearing, and on the part of the nervous apparatus of vision, of:

(*a*) The peculiar form of contraction of the field of vision.

(*b*) Too rapid disappearance from view, of any given fixed object.

(*c*) Diminution of central vision.

[1] Rembold: Ueber Pupillarbewegung und deren Bedeutung bei den Krankheiten des Centralnervensystems, Mittheil. a.d. ophth. Klinik in Tübingen, 1880; Beard, *l. c.*, page 27; Rählmann, *Volkmann's Vorträge*, No. 185, 1880, Satz 5.

(*d*) Sudden attacks of obscuration of vision, and processions of scotomata.

(*e*) Lack of fixation of the optical memory-images.

(*f*) Lack of ability to read or to work for any length of time.

(*g*) Symptoms of weariness on the part of the muscles, both of the eyes and eyelids.

(*a*) The most prominent symptom to attract our attention on examining cases of neurasthenic asthenopia is the **peculiar form of contraction of the field of vision,** which, now more, now less distinctly marked, is common to all of them, and may serve at the time as a measure of the abnormal condition of the entire optical apparatus.

We have already described the greater contraction of the field of vision toward one side more than toward the other; but in the form of this limitation of the field there are two larger and more distinct groups which, although simply exhibiting an increased intensity of one and the same condition, may yet be definitely differentiated in a diagnostic as well as prognostic point of view. In the one form, the field of vision toward the one side is above the normal, or normal or but slightly contracted toward the centre (beyond the normal in cases 2, 6, 7, 8, 11, 18; normal in cases 1, 10, 12, 16, 17, 20; or contracted a little concentrically, as in cases 3, 4, 5, 13, 15). In the second form a noticeable contraction in a high degree is present at the very beginning of the examination (as in cases 22, 23, 21, 19, 14, 9, and in the cases mentioned in note on pages 446 and 447.

Although any perfectly healthy eye will at last give out after long-continued exertion, and then exhibit symptoms more or less resembling those which we have here attempted to describe, yet these symptoms in the eyes of neurasthenic patients appear at a much earlier period and in a more decidedly intense manner. When in a healthy person the field of vision examined in an analogous manner does not, even after the prolonged examination, necessarily, reach the outermost limits of perfect perception of objects, in neurasthenic conditions, on the contrary, we can easily discern va-

rious symptoms of weariness and diminution of function, even after examination of the first meridian. Inasmuch as these forms vacillate on the border line between health and disease, we often obtain measured fields of vision, in which the greater tendency to weariness is but slightly pronounced, in comparison with those in which this symptom appears in its most pregnant form. Such transition stages, therefore, which bridge over the interval between the healthy and the pathological symptoms, are of the greatest value so far as concerns our knowledge of the so-called anæsthesia of the retina.

Still the field of vision obtained by the method described in the beginning of this paper, does not represent the absolute condition of peripheral vision, but merely the relative condition of the optical nervous activity, dependent upon the demands which are at the time made upon the function as well as the amount of work which the eyes have previously had to perform. The field of vision thus obtained is, as we may say, a product of art, which gives a sufficiently accurate key to the condition of the optical nervous energy during the examination of each separate meridian (taking into consideration the time that has already been spent in the examination); but it cannot by any means represent the absolute extent of the field of vision of the eye that has just been examined. This is, nevertheless, approximately given by the external boundary lines of the first examination, and then of the control examination of the same field of vision, presupposing, of course, that the limitation which was discovered in the meridians examined later was also produced in the beginning of the examination of the meridian concerned by over-exertion of the eye.

If we are to consider that this view has been proved by the investigations now lying before us, then the field of vision in the great majority of the cases which we have described, provided the eye has had a chance to rest, must be regarded as perfectly normal. Whilst the field of vision in the first category of cases is beyond the normal extent, or has at least normal limits in every meridian in the beginning of the examination, yet we see in the horizontal as in

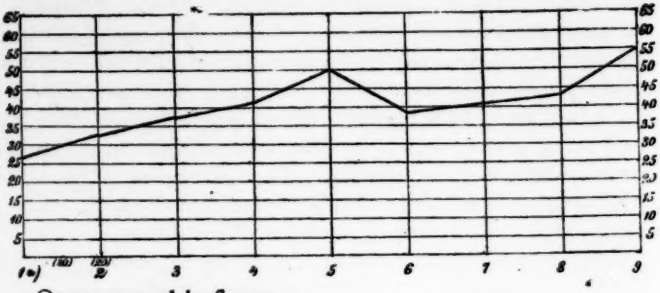
the first meridian examined that the function of the optical nervous system decreases toward the end of that meridian, until finally the white object which is used for the examination can no longer be perceived long before it has reached the normal limit of the field of vision. As the weariness increases, the visual field in each of the following meridians will become more and more contracted toward the end of each separate meridian, while the slight amount of rest which is granted to the eye as the test-object is again pushed out toward the end of the perimeter hoop and placed in a new meridian, is quite sufficient to show in a few of the adjacent meridians an almost normal extent of the field. But in the examination of the ninth meridian, as well as of the last of all in the schemata lying before us, we find even at the incipient stage of the examination a decided contraction. Still it is remarkable that, after we examine in the method suggested the five meridians upward or downward from the horizontal meridian and the eye is already moderately weary, examination of the sixth meridian, as well as of the one lying next to the horizontal, shows over and over again a less decided contraction than would have been expected from that which had already been noticed during the examination of the five preceding meridians. The cause of this phenomenon is partially to be sought for in the circumstance that in the horizontal meridian the normal field of vision shows its greatest extent, and partly in the circumstance that we are obliged to rotate the hoop of the perimeter around the whole octant, so that we thus allow the eye a longer period for rest and recovery from its previous weariness.

If we add together the number of degrees by which the visual field of each meridian falls below the extent of the normal field of vision when measured as we have suggested, and divide the sum[2] by the number of fields thus measured (sixty-eight in twenty-four cases from thirty-six eyes),[1] we obtain the following curve, in which the ordinates[2] repre-

[1] The six cases, with twelve fields of a later date, are not to be counted.

[2] Every two meridians of the scheme invariably form an angle of twenty degrees with one another.

sent the sequence of the meridians examined, corresponding to the number placed beneath, while the abscissæ denote the number of degrees by which in every meridian the field of vision fell short of the normal extent.



Or expressed in figures:

Meridian.	Extent of the Defect.	Meridian.	Extent of the Defect.
1	$26\frac{2}{3}°$	6	$38\frac{1}{4}°$
2	$32\frac{1}{2}°$	7	$40\frac{1}{4}°$
3	$37\frac{1}{3}°$	8	$43\frac{1}{3}°$
4	$40\frac{1}{16}°$	9	$54\frac{1}{2}°$
5	$50\frac{1}{3}°$		

Expressed in words, this would mean that even in the examination of the first meridian, the field of vision in a neurasthenic patient, as a result of slight weariness, falls off from the normal extent at least twenty-six degrees on the average, while in the other meridians this defect is still more marked.

This curve will only suit those cases which are examined on Förster's perimeter on the above-developed principles; experience alone can tell what form the curve would assume in case of analogous examinations with other perimeters in which the eye has no opportunity to rest before being tested for subsequent meridians.

The limit of the field of vision in all of our cases was assumed to be the point at which the test-object had wholly disappeared from the perception of the examined eye.

It is, however, very evident from the following important phenomena, that the visual fields in the so-called anæsthesia of the retina, no matter by what method the examination is

made, do not exhibit the absolute value of the amount of peripheral vision that is actually present. For if we examine several times in one day, or on several successive days, the visual field of one and the same eye in apparently the same external condition at each sitting, we shall never, or at least rarely, obtain the same form and the same extent of the field as we should have expected to find from our previous examination. This is, indeed, the only way in which we can possibly explain the paradoxical phenomenon of patients with extremely contracted fields of vision in both eyes,[1] being able to walk about the house and street with perfect freedom and total lack of hesitation, although from the extent of the defects in their visual fields we should be inclined to think, and even to assert, that they could not find their way about without some one to guide them. Thus the patient with the highly contracted field in case 14 gave no hint from her movements, or her behavior, of this extreme degree of limitation, nor of the extensive diminution of vision, both of which had been objectively and accurately determined. Another patient, whom I had an opportunity of examining in the hospital, exhibited, in connection with clonic blepharospasm, extraordinary diminution of vision, and excessive photophobia, a field of vision more extensively contracted than I had ever seen in any but a few cases of glaucoma, and yet he moved about in so nonchalant a manner that for a long time I could not rid myself of the idea that he was shamming. It is possible in such cases as these that so high a degree of hyperæsthesia (or greater tendency to weariness) exists, that when called upon for more than the average amount of work (as they are for the determination of the acuteness of vision and extent of the visual field) the relative insuffi-

[1] One of my most recent cases is as follows: A young girl belonging to a nervous family, with numerous nervous constitutional symptoms, complains of a high degree of amblyopia in both eyes. S $\frac{20}{100}$, Snellen 2 when close to the eyes; micropsia. No improvement by glasses. Ophthalmoscope normal; emmetropia; reaction of pupils normal, but in each eye a colossal contraction of the field of vision, almost every meridian showing only an extent of about five degrees from the point of fixation. And yet with this enormous contraction, movements are in nowise hindered. The girl goes about everywhere just as if she possessed normal vision as well as a normal field. The color-sense is also perfect.

ciency of their nervous energy comes early into play, whilst on the contrary the absolute extent of the visual field is much greater when they can roam about at will without being obliged to fix any object with their eyes; in other words, without being compelled to exert their eyes to any great amount. Perhaps we might prove such assertions as these by examining the field of vision with a test-object 40 *mm.* □ instead of one 5 *mm.* ⊏, in which case less exertion for peripheral vision on the part of the patient would be demanded. Nevertheless, such a comparative examination as this could not be of extreme value, from the very fact that, owing to the necessarily frequent variations in the intensity of the symptoms in every case of this nature, the visual field of one day may differ exceedingly from that of the same eye to-morrow, so that we should never be free from various sources of error in comparing the results of the two methods of examination.

The visual fields for color show about the same conditions as for white. In the last case that I have met with (see note on page 457), with extreme contraction of the visual field, all colors, even the most minute patches of color, were accurately recognized, while the visual field for these was of precisely the same extent as that for white.

One of the most interesting phenomena observed in many of these patients, during the examination for one or all of the meridians, is the repeated and intermittent disappearance and alternate reappearance and disappearance at short intervals of the white test-object. In Fig. 23 we see the result of the first examination of the visual field, and in Fig. 24 the result obtained by similar measurement after the eye had been rested for a quarter of an hour. These show the intermittency of disappearance and reappearance of the test-object just described. They also exhibit the results of the examination of the right eye in case 19, four weeks after the field in Fig. 19 had been obtained in the usual manner. In the latter figure, also, we notice some zonular defects.

Just in the same way as a frequent change in the locality of the pains, and frequent variations in the intensity of the

distress on the part of various organs, is one of the characteristics of neurasthenia, and, moreover, just as the morbid symptoms in this affection may occasionally attack but one half of the body, or at least be more pronounced on one side of the body only, so do the fields of vision in the two eyes show analogous defects (but not always with equally marked intensity), even when drawn from measurements made within one and the same hour. Case 19 with its zonular defects, and Figs. 23 and 24, show the variations to which the form of the field of vision is subjected during the brief space of even three quarters of an hour.

(*b*) Although the last-mentioned phenomena are merely concerned with the expression of the function of those nervous elements of the optical apparatus which preside over the conduction and perception of peripheral impressions of light, yet we find a precisely similar condition of things in the perception and conduction from the macula lutea. It is well known that if the normal eye gazes too long and too fixedly at any given object, the latter finally disappears entirely from the field of vision. As the conditions of which we are now speaking waver on the border line between health and disease, and as many symptoms which in an exaggerated form would be regarded as morbid must in a milder form be considered simply as the normal expressions of the healthy organism, so here also we meet with complaints which, dependent upon the vocation and livelihood of the patients, would be insisted upon by some as the most distressing, by others as the least so, of all their varying complex of symptoms. For instance, a young teacher with astigmatism capable of correction, with slight insufficiency of the internal recti, and symptoms indicating cerebral neurasthenia, came to me for advice, fearing that he should be obliged to resign his position, because, when translating or correcting the exercise books of his scholars, he noticed very frequently that the spot upon which he had but an instant before directed his eyes would suddenly grow misty, and then in an instant disappear from sight. The clinical reports of cases show us how often similar complaints are made by patients of this

class. Even during the examinations at the perimeter, the fixation-object frequently disappears from sight and then reappears, although during the entire examination the patient has not failed to keep his eyes fixed closely upon it.

(*c*) It is also impossible for us to fix the precise degree of **diminution of vision,** which in cases of this affection shows extreme fluctuations, although generally the sight is not greatly diminished. In case 10, *e. g.*, vision varied frequently, but could never be raised above $\frac{20}{30}$. In case 9, vision when tested directly after an examination with the perimeter, that is to say, when the eye was decidedly weary, was $\frac{20}{50}$; after resting a quarter of an hour it increased to $\frac{20}{40}$; while five weeks later, after improvement of the constitutional symptoms, it amounted to $\frac{20}{30}$. In case 15, in which vision was generally $\frac{20}{30}$, it sank from excessive weariness to $\frac{20}{70}$, just as in case 18, in which it fell from $\frac{20}{40}$ to $\frac{20}{70}$. In the latter case, also, it invariably showed a steady variation, to-day one thing and to-morrow quite different. In case 10 the same symptom was confirmed.

In thirteen of the cases cited in this paper, vision was found to be normal; in five it amounted to $\frac{20}{30}$; in four, $\frac{20}{40}$ to $\frac{20}{70}$; and in two, $\frac{4}{100}$. In some of the latter cases, however, anomalies of refraction also existed, which may have contributed partially to the diminution of vision. But it has already been proved that neither the sight nor the field of vision in their absolute extent can be so slight as they appear in case 14, as well as in the case cited in note on page 457. In explaining the diminution of vision in neurasthenic patients, we must not forget to consider the following points: It is, for instance, a fact that when these patients are *compelled to see*, they see with much less acuteness than when they test their eyes by themselves, or accidentally as it were. As in the case already so frequently mentioned (note, page 457), the patient possessed vision of only $\frac{20}{200}$, and could only distinguish common type when held extremely close to the eyes, yet she could really see so well that when riding in the horse-car, and sitting opposite her father, she called his attention to a very minute

defect in his trousers, which had entirely escaped his own attention. Since the letters at which these patients look intently disappear with great facility, so that they are obliged to give increased attention to the deciphering of printed matter, while at the same time the cerebral activity so easily tires, and, moreover, since spasm of accommodation makes its appearance at an early date, whenever increased demands are laid upon the specific energy of the eyes in their efforts to see, it is possible that the co-ordinate action of these two circumstances may explain the remarkable diminution of vision which we occasionally observe when testing the patients with type, as well as the fact that the results of the tests for near and distant vision so rarely coincide.

(*d*) **The duration of the attacks of obscured vision** is usually given by the patients as a few minutes, the mist falling over the sight just as if a veil had been drawn over the eyes, or the room suddenly filled with fog or cigar smoke, or a shiny membrane drawn against the eyes, then suddenly removed and so disappearing. One of the patients (case 15) was greatly terrified with this phenomenon. While sitting at the whist table every thing suddenly appeared to be covered with a thick fog, only she could still clearly distinguish (as if looking at them through a crack) the objects at which she was looking directly. Another lady (case 19) could generally see all objects that she fixed, while every thing else about her disappeared as if in a fog. It is difficult to define the precise cause of this disturbance of vision, for during the attacks the refracting media remain perfectly normal and transparent. It is possible, as Mooren has suggested (*l. c.*), that transitory œdema, originating in vaso-motor disturbances, may interrupt the conduction of light toward the cortical centres (the pupils still react promptly to light), or that as a result of over-weariness the excitability of the optical nervous system decreases to such an extent that, with all the external circumstances precisely similar, such images as are not brilliantly illuminated, and particularly those which fall upon the periphery of the retina, make a blurred, indistinct impression. In some of the cases, however, this condition of

clouded vision (or as a lady observed, "my sight appears as if covered with a dove-blue veil") persists, though not so intensely as at first, for several days in succession. It is possible that those vanishing shadows and colored or dark rings and globes which are seen by so many patients, can be explained in the same way as partial transitory amaurosis, by spasmodic conditions of the vaso-motor spheres along the nervous visual apparatus, only that in this case the conditions are much more circumscribed and transitory than in the former.

(*e*) Just as in neurasthenia the memory is so altered that the patients are extraordinarily forgetful and absent-minded, cannot easily concentrate their thoughts, and often, as they express it, lead a dreamy existence, even frequently exhibiting conditions which vary but little, if any, from hypnotism, so do we meet with similar complaints on the part of the visual spheres. I lately examined the eyes of a ship-broker who complained that his business was injured by the fact that the faces of people with whom he had just finished transacting business, would in the space of a few minutes entirely escape his memory. If he happened to meet these people on the street only a few minutes after they had left his store, he would pass them by without any more recognition than if he had never before seen them. He complained of the same mortifying symptoms, in his memory-pictures of houses, façades, etc. The patient was slightly hypermetropic, had perfect vision, but complained of many nervous disorders, and recalled to mind that he had always been rather "dreamy." Another gentleman complained that when he had read for some length of time, he would make out the words to signify something entirely different from their real meaning. The patient belongs to an exceedingly nervous family, suffers from migraine, and leads a fast life with women; he is hypermetropic $\frac{1}{10}$, and has perfect vision. He thinks that he used to be much more nervous during his school days than at present. He used, also, at that time to consult one oculist after another, and "for six months daily to test his eyes with various glasses," without ever having discovered but one that could help him in the

least. At the age of twenty-one he received a certificate of disability on account of his eyes and was exempted from military duty, although with his normal vision it would have been eminently proper for him to serve out his time in the army. In his youth he suffered, moreover, from all the peculiar phenomena of neurasthenic asthenopia, and even now his visual field exhibits symptoms of easily acquired weariness of the optical nervous apparatus.

(*f*) **The inability to use the eyes for any length of time at close work** has its foundation in the greater tendency to weariness on the part of the entire optical nervous apparatus, as well as in the more rapid fatigue of the ocular muscles and particularly of the recti interni. Indeed, we find in almost every one of these patients a more or less pronounced insufficiency of the latter muscles.[1] There is a lack of the nervous force necessary for long-continued fixation. On the part of the muscle of accommodation also we meet with a condition of relaxation, which alternating with convulsive contraction produces at one time macropsia, at another micropsia, and in connection with the insufficiency of the muscles makes the fixation-object on the perimeter, or the printed letters on the page, at one time appear as if farther off, at another nearer at hand.

I made a special examination of the breadth of accommodation in all of the cases which I have reported, and found it normal with but few exceptions. Spasm of accommodation also is occasionally present, or appears very soon after any attempts at close work with the eyes.[2] If hypermetropia or astigmatism is present in patients of this class, their complaints are, of course, increased by the accommodative asthenopia, while only too often does even a slight demand upon the function of the eyes produce reflex symptoms that originate in the sensitive spheres.

(*g*) **The transitory symptom of diplopia and the occasional appearance of slight ptosis** can also be justifiably referred to these conditions of weariness, or even paresis, as

[1] Compare also Higgens, *Nagel's Jahresbericht*, 1875, p. 507.

[2] Thompson: Spasm of Accommodation, *American Practitioner*, 1872, page 96. See also *Nagel's Jahresbericht*, 1872, page 454.

we may venture to call them. This phenomenon shows itself in the remainder of the muscular system by general lassitude, indolent carriage of the body, lameness in various limbs, and in the peripheral sensitive nerves by a numb feeling in the fingers, hands, and feet, and by a "going to sleep" in the legs. In the point of view of a differential diagnosis, we may venture to emphasize the fact that ptosis and sudden attacks of diplopia are by no means uncommon in the incipient stage of tabes, but that under these circumstances paretic conditions or genuine paralysis are the essential cause, and beyond this the diplopia in tabes always continues for weeks or months, while in neurasthenia it passes off in a few minutes. In thirteen tabetic patients, whom I observed for many months, I discovered six disturbances of the muscular apparatus of the eye, in two of which permanent paralysis ensued.

Inclination to reflex action toward the motor and sensitive spheres.

The extraordinarily frequent occurrence of clonic blepharospasm in retinal anæsthesia is well known, and has been mentioned by a large number of writers. After one of my patients had exerted his eyes for a short time only during the examination with the perimeter, there set in a clonic blepharospasm which gradually spread over every muscle of the face, produced clonic spasmodic nodding of the head, and at last excited general convulsions, so that I was compelled to drag the half-unconscious man away from the perimeter. The appearance of macropsia in these conditions can easily be explained by assuming a spasm of the muscles of accommodation. So far as concerns the reflex symptoms from the sensitive spheres, these patients frequently complain of headache and pain in the temples the moment that they are dazzled by artificial or any over-abundant amount of light. Förster explains this phenomenon by contrasts of illumination in the field of vision, which are more marked when artificial light is employed than in diffuse daylight. One of my patients, indeed, declared that these irresistible impressions which she felt were due to

contrasts of light. An exquisitely neurasthenic gentleman, belonging to a highly neuropathic family, and who was affected with excessive hyperæmia of the optic papillæ, could not possibly converse with people who wore well-contrasted checkered clothes, for the mere effort of looking at them would give him the most violent headache imaginable and attacks of malaise. Nor must we forget to mention at this point the *chromatophobia* of nervous people, which should, in my opinion, be properly considered as an idiosyncrasy.[1] Many patients also complain of "unendurable" pain when they exert their eyes for reading or close work, even when the existing hypermetropia has been corrected by suitable glasses, and prisms placed before the eyes to relieve the insufficiency of the internal recti.

If we have succeeded in showing that together with the symptoms on the part of the optical nervous apparatus similar and equally valuable symptoms are to be noticed from all the other nervous qualities of the entire organism, and if it is a fact that not a single case of the so-called anæsthesia of the retina produces symptoms which are specifically those of the optical nerves of special sense, but that in every one of them we can sooner or later discover analogous symptoms on the part of the other nerves, we have offered proof that the anæsthesia of the retina is not a mere local self-sufficient affection, but that it must necessarily be regarded as the local manifestation of a general neurasthenic condition, and that, as a matter of course, the entire complex of symptoms exhibited by the eye ought more correctly to be entitled "neurasthenic asthenopia." Although the cases now lying before us exhibit all the grades of intensity of this half-physiological, half-pathological phenomenon, and although in a few of them the special symptoms which belong to anæsthesia of the retina, as this term was formerly employed, are not extremely well marked, yet even the latter cases offered the unmistakable tokens of this condition, and proved without a doubt that, with the frequent variation in complaints,

[1] V. Hasner, *Centralblatt f. A.*, 1881, p. 1; Mayerhausen, *ibid.*, 1882, p. 348.

sooner or later the ocular symptoms to which we have especially devoted our attention will appear in a more pregnant form, taking it for granted, of course, that, as the history of the cases would show, they had not already exhibited them in the supposed intensity.

Rudolf Arndt compares the function of the nervous system in neurasthenics with the laws of the contractility of weary and exhausted nerves. It is well worth our while and very important from a diagnostic point of view to place side by side the symptoms observed on the part of the nervous visual apparatus in neurasthenia and those which we observe in the tabetic form, especially of atrophy of the optic nerve. In both of these conditions we find transitory disturbances of the muscular system, ptosis, hallucinations of vision, photopsies, colored mist particularly in the defective portions of the visual field, obscurations of vision, diminished acuteness of vision, dazzling by light, concentric contraction of the field of vision,—in neurasthenic asthenopia, however, without prejudice to the sense of colors and with prompt reaction of the pupils to incident light. We shall, however, show later in this paper, by citations from two cases, that in atrophy of the optic nerve from tabes also, the visual field is subject to modifications similar to those already described in cases of neurasthenic asthenopia. The appearance on the part of the nervous apparatus of vision, as well in neurasthenia as in spinal affections, of symptoms similar, yet prognostically of so diametrical importance, can be explained by the influence which the spinal marrow exerts upon the vascular distribution of the retina, as already convincingly demonstrated by Rieger and v. Forster.

The **differential diagnosis** of neurasthenic asthenopia from other severe pathological conditions of the eye, amongst which, however, only progressive atrophy of the optic nerve, glaucoma, and occasionally sympathetic ophthalmia are to be mentioned, is supported by exact conditions which enable us easily to differentiate the symptoms of the former from those of the latter pernicious affections of the eye. We are obliged in this paper to leave unmentioned the symptoms of hysterical amaurosis and amblyopia with hemi-

anæsthesia, as observed by French authors chiefly, since the material at hand is too scanty to assist us in drawing conclusions that would be sufficiently convincing for the purpose of a differential diagnosis.

Our first duty is to observe in the most careful way the general bodily condition. For it is this which offers abundant suggestions, the chief of which, and one which we cannot too much accentuate, in a diagnostic point of view, in patients who offer the most intense symptoms of neurasthenic asthenopia, is the paradoxical relation between the condition of their acuteness of vision as well as their field of vision, and their unimpeded movements and behavior. It would indeed be impossible for patients with vision reduced so low by glaucoma or optic-nerve atrophy, and visual fields contracted so concentrically, to move about so freely, as has over and over again been observed in typical cases of neurasthenic asthenopia. A second important point is the extraordinarily frequent and brusque variations in the form of the visual fields. If we are in the invariable habit of examining the field of vision by pushing the fixation-object from the periphery toward the middle point of the perimeter without following each meridian successively, and without clinging to one fixed direction upon any given meridian, until we have discovered the peripheral limit of the field for that meridian, we shall easily be liable to such an error as happened in case 19.

This patient, a healthy-looking young lady, presented herself with the complaint that she had fallen upon the back of her head a year before, and had been short-sighted ever since. She said that after recovering consciousness every thing seemed as if covered with a cloud; she was also seriously annoyed with photopsies, and suffered from severe and frequent headache, which grew decidedly worse when she indulged in any mental exertion. Examination showed moderate myopia (the patient's mother was very myopic), with normal acuteness of vision. The ophthalmoscope revealed a well-marked hyperæmic condition of the optic papilla, together with enlargement and varicosity of the vessels. The field of vision in both eyes showed a few peripheral defects, while the field for colors, taken on the same day, showed a well-marked contraction

toward the centre. I was of the opinion, from the ophthalmoscopic condition and the history of the fall, that this was a case of some incipient neuritic process, and therefore directed the treatment suitable for such conditions. Fourteen days later I discovered normal vision with the same ophthalmoscopic condition, associated with a high degree of contraction in the visual field, so that my suspicions of neurasthenic asthenopia were at once excited. The further history of the case has been given in the previous part of this paper, while the field of vision when measured in the manner already suggested made the diagnosis perfectly clear (see Figs. 19, 23, and 24).

Another important diagnostic symptom is the prompt and extensive reaction which the pupils invariably show to incident light. Although we sometimes observe a difference in the size of the pupils, yet the phenomenon of reflex stiffness of the pupil has nothing in common with neurasthenic symptoms, and belongs to the district of organic spinal affections,—particularly of tabes. The disproportion between the ophthalmoscopic condition of the fundus of the eye and the degree of functional disturbance is common to functional diseases as to incipient organic diseases,—at least to those which begin with retrobulbar nervous affections. For, as Rieger and v. Forster have shown,[1] symptoms similar to these already mentioned on the part of the optical nerves of sense may appear in cases of organic affections of the spine without the necessary presence of alterations which the ophthalmoscope might detect. Hyperæmia, also, of the optic papilla, as occasionally observed in the preliminary stages of spinal diseases, together with a slight neuritic affection of the papilla, are of but slight value in a diagnostic point of view, since analogous conditions of hyperæmia may be witnessed in neurasthenic patients, while a slight œdema of the papilla, such as may well occur in neurasthenia, could hardly be differentially diagnosticated from a slight neuritis.

The patella-reflex is always present in neurasthenia.

If the sudden attacks of obscuration of vision should incline us to imagine that the case was one of glaucoma, we

[1] *V. Graefe's Archiv*, Band xxvii, Heft 3, p. 109.

should not forget that the colored halos observed around all artificial lights in the latter affection, are never complained of in neurasthenic asthenopia. On the contrary, the obscuration of vision is by no means rare in the incipient stages of tabes, even when there are no complications whatsoever on the part of the optic nerve. In thirteen tabetic patients whom I am now treating for affections of the eye (twelve for atrophy of the optic nerve), this symptom was noted in four. Two of these are now affected with atrophy of the optic nerve,—one had a transitory paresis of the abducens, and now has incipient atrophy in one eye ; the other patient suffers from a chronic iritis. These patients, even when in the bloom of health, years and years ago, were forced to interrupt their work at intervals, because for half an hour or an hour at a time their vision would be obscured by a thick cloud.

Nor, in making up our differential diagnosis, should we forget the vicarious symptoms exhibited by other portions of the body in the place of disturbances in the eye. Thus, *e. g.*, I remember a few cases in which the most urgent complaints of trouble in the eye disappeared like a flash, while their place was taken by similar complaints on the part of the senses of smell and taste, and particularly of hearing.

In all of these cases, except one, the sense of colors was intact, and in this the lady (case 14) simply called "red" a "reddish brown." Here the affection had lasted for years with varying intensity ; but now, after a few years, the patient sees much better. Further observations are necessary in order to determine whether cases like the one just mentioned may not in time develop into a neuritis and then degenerate into atrophy of the optic nerve, and represent, perhaps, the harbinger of that optic neuritis and optic atrophy occasionally observed in women who are sterile or suffering from anomalies of menstruation. It would seem, however, as if the cases reported by Mooren, Rieger and v. Forster would support such an idea as this.

Although glaucoma, or atrophy of the optic nerve, or

retrobulbar affections of the optic nerve, bring about a concentric contraction of the field of vision, yet some of these defects are constant and permanent, owing to the pathological lesion once caused, but chiefly to the destruction of some fibres of the optic nerve. Still, we meet here also with conditions which, with a predominant fundamental disease, can only be explained by transitory, though deeper, exhaustion of the entire nerve. In a tabetic patient with double atrophy of the optic nerves I observed the following state of affairs: one of the eyes was totally amaurotic, while in the other eye the sight had decreased most ominously within a few weeks. Examination of the visual field with a white fixation-object of 5 *mm.* □ showed deep sector-like defects, mostly outward, as far as the tenth degree of Förster's blank. The patient was very irritable and exceedingly sensitive to the very sight and proximity of a mother-in-law who lived in the same house with himself. A vacation of three weeks in the country, bodily rest, and the use of pills of silver-nitrate produced a well-marked enlargement of the field of vision, and awakened once more the perception for blue and red, which previously had entirely disappeared. Nevertheless, the diminution of vision remained as before, the stiffness of the pupils persisted, but the patella-reflex could not be produced, despite the undeniable improvement in bodily health. The indented lines (Fig. 25) show the extent of the field of vision at the patient's first visit, when, by the way, the field was not examined in the method previously detailed. The uninterrupted and interrupted lines represent the measurement and counter-measurement of the visual field according to the above-mentioned principle, after four weeks' vacation in the country. We see that the hatched defects (as they also were found by a measurement made eight days before, according to the usual method) are still present, but that within the field which has been preserved, we see indicated those very vacillations which we have found to be characteristic of neurasthenic asthenopia. This enlargement of the visual field, in comparison with the high degree of contraction at the first measurement, can only be explained by

exhaustion of the optical nervous system which had gone along, hand-in-hand, with the fundamental process, but which diminished owing to improved external conditions and therapeutic regulations, while the pathological lesion, once produced, persisted to the end.

This phenomenon was still more decidedly marked in the case of an hereditary tabetic patient, with a low degree of vision, grayish optic papillæ, hallucinations of vision, dazzling by light, vision of colored mists, reflex dilatation of pupils, absence of the patella-reflex, lancinating pains, transitory diplopia, and ataxia. I have observed this case since November, 1881, and have made six measurements of each eye without ever finding a single visual field that greatly resembled or coincided with another. The sector-shaped defects appeared in both eyes, chiefly in the temporal half of the field, and we discovered the following limitation in degrees (the field measured according to the old method).

LEFT EYE.			RIGHT EYE.		
1	Meridian	16°	1	Meridian	18°
2	"	26°	2	"	18°
3	"	28°	3	"	6°
4	"	26°	4	"	12°
5	"	21°	5	"	18°
6	"	15°	6	"	14°
7	"	13°	7	"	18°
8	"	19°	8	"	12°
9	"	16°	9	"	18°

OUTWARD.

The following visual fields (Figs. 26 and 27), lately taken on the modified principles above mentioned, show the absolute defects in the visual field outward, in an amount approaching the medium from the five previous examinations.

We see that in the tabetic form of atrophy of the optic nerve the absolute defects of the visual field show those ominous deep indentations in the shape of sectors, in opposition to the equally circular concentric contraction of the concentrically narrowed fields of vision in cases 4, 5, 9, 13, 14, 15, 19, 21, and 22. There the perception of colors was

entirely preserved; here, however, no color is distinguished any more. Another syphilitic patient suffering from tabes, with paralysis of the right abducens, atactic symptoms, lack of knee-reflex, hyperæmia of both discs, which were slightly dotted at the external margin, had sector-shaped defects of the right temporal half of the visual field, at one point extending to the thirty-fifth degree. Here even some fluctuations occurred in taking the visual field, although a certain zone outward presented an absolute defect. The man said he had been very nervous during the last year, with fright, palpitations, and sensitiveness to noises. The pupil of the right eye, which was affected, was of medium size, reacted upon light, whereas the pupil of the left, apparently normal, eye was dilated, and showed reflective immobility. The central perception of colors was normal in both, but the peripheric was very much narrowed in the right eye, especially in its temporal portion.

Changes of symptoms and variations of their intensity are characteristics of neurasthenia. The great number of appearing and disappearing symptoms are explained from reflex excitations of the sympathetic and vaso-motor nerves. These excitations may start from and pass to any part of the body, as vaso-motor fluxions float here and there, whereas in other organs a transient anæmia is produced by spastic conditions. The brain, the digestive, and reproductive systems have to be considered as the chief centres of irritation.

In regard to the etiology, we have to distinguish two large groups, as in the one the disposition is congenital, in the other it is acquired. Although masturbation, practised too frequently and for a long time, acts undoubtedly obnoxiously upon the organism, and produces renewed complaints in nervous individuals, we cannot, from a general point of view, consider those hyperæsthetic conditions merely as a direct consequence of masturbation. One of my female patients attributed the commencement of her condition to a sudden fright. Its cause, a visual hallucination, was, however, the expression of the existing neurasthenia. In another case the symptoms followed immediately the recovery from a serious consuming disease. Very fre-

quently these conditions occur in anæmia and chlorosis. The lack of nutrition of the body in consequence of the latter may bring about mal-nutrition of the pelvic organs, with irritation of the ovaries, congestion and dislocation of the uterus. Förster and Freund (*Graefe-Sämisch*, Bd. vii) could trace conditions of that kind to a chronic atrophic parametritis in numerous cases. In case 7, and in some cases observed by Mooren,[1] the affection was caused by genital disorder after labor, so that the nervous symptoms were secondary. As, however, the disease occurs even in males, and as in many cases no genital disturbances are present, it is evident that not all cases of neurasthenic asthenopia are of an ovarial or uterine origin. These complaints are frequently met with in young girls shortly before or after the commencement of menstruation. In one of my female patients the complaints of neurasthenic asthenopia continued as long as the disorders of her first menstruation (case 10). In another one the symptoms followed immediately a serious concussion of the brain after a fall upon the occiput. This case illustrates somewhat the theory of the traumatic retinal anæsthesia.[2]

As in this young lady the general symptoms of neurasthenia with the ophthalmic affection were very distinctly pronounced, and the development of neurasthenia followed immediately that serious concussion of the brain, this case shows, that this so-called traumatic anæsthesia of the retina is not only to be explained by a local influence upon the nervous visual apparatus, but that the changes of the nervous system, caused by the concussion of the brain, manifested themselves in the above-mentioned manner in the eye as well as in the whole organism.

A case observed by a physician of this city in a lady proves that these symptoms may occur suddenly and ap-

[1] Mooren, *l. c.* Vance: The Effect of Menstrual Disorders upon the Vascularity and Nutrition of the Intra-Ocular Structure. Ref., *Nagel's Jahresb. f. Ophth.*, 1872, p. 342.

[2] Woodsworth: Defects of Vision Attributed to Railway Collision, *Proc. of the Med. Soc. of London*, 1881, Bd. v., p. 310; Hogg: Impairment or Loss of Vision from Spinal Concussion or Shock, *Med. Press and Circul.*, Dec. 1, 1875, p. 449; ref., *Nagel's Jahresber.*, 1875, p. 362, and Schiess-Gemuseus, ref., *Nagel's J. f. O.*, Bd. vii, p. 415, case 2.

parently without an external cause. In this case the symptoms of the eye were prevalent, and the vaso-motor disturbances appeared most evident by a sudden redness of the face and ciliary injection.

The etiological data in regard to my patients are given in the following table, with sex and age:

	Age.	Etiology.
Girls.	12 years.	Commencement of menses.
	13 "	Menses did not begin yet.
	14 "	Irregular commencement of menses, together with episcleritis.
	14 "	Chorea. Neuropathic constitution.
	15 "	Concussion of the brain.
	17 "	Chlorosis. Chorea.
	17 "	Chlorosis.
	17 "	Infantile uterus. Great menstrual disturbances.
	18 "	Chlorosis. Hereditary phthisical constitution.
	22 "	Chlorosis. Violent emotions of mind. Betrothed for many years.
	23 "	Chlorosis and menstrual anomalies.
	23 "	Cause not known.
	23 "	Uterine affections. Anteversi uteri.
	23 "	Companion of an epileptic and lunatic lady.
	26 "	Violent fright after a visual hallucination.
	26 "	Prostitute; affection of the uterus.
	30 "	Congenital nystagmus.
	60 "	Hereditary neurasthenia. Chlorosis. Menstrual anomalies.
Women.	28 "	Hysteria.
	30 "	Neuropathia hereditary in the family.
	31 "	Neuropathia hereditary. Chlorosis from childhood.
	31 "	Affection of uterus.
	32 "	Descensus uteri.
	34 "	Neuropathy hereditary.
	34 "	After a serious acute rheumatism and diphtheria.
	43 "	Hereditary affections. Hysteria. Affection of uterus.
	47 "	Perineal rupture. Prolapsus uteri.
Men.	24 "	Neuropathia hereditary. Hysteria.
	34 "	Lues. Excessive sexual indulgence and masturbation.
	44 "	Neuropathia hereditary. Exhausting pollutions.

The nystagmus of minors has to be mentioned here as an etiological moment, in which I found similar conditions as in anæsthesia of the retina. *Klin. Monatsbl. f. Augenheilk.*, 1879, p. 131.

Beard, as above mentioned, considers the cause of the disturbances in neurasthenia to be found in the vaso-motor system, and thinks that the slight hyperæmia of the optic disc, so frequently observed, is the objective proof of his opinion, saying: "Mere hyperæmia is not necessarily a

pathological condition and does not always bring about disagreeable symptoms in healthy persons; if, however, a person is neurasthenic, a slight disturbance of circulation, a small affluxion of blood, a congestion caused by a vaso-motor paresis, noticeable perhaps only by close examination, may produce violent symptoms. By the combined action of the cerebro-spinal and vaso-motor nerves, in all their ramifications and connections, the large and small vessels are everywhere enabled to change their diameter by reflex action from any part of the body." It is, however, difficult to decide, whether those asthenopic affections have really to be attributed to this slight hyperæmia of the optic nerve, which may be observed on ophthalmoscopical examination. Observations of many cases would be necessary, showing that a large number of those symptoms disappear when the discs become paler. One of my cases seems to support the correctness of Beard's opinion. As above mentioned, the ophthalmoscopical examination in case 19 showed such a considerable hyperæmia of the discs, that I believed in a beginning neuritis for some time. As long as this ophthalmoscopical anomaly existed, the symptoms about the eyes continued. The patient called again after some weeks, with a perfect change of her symptoms. The pathological conditions of the optic nerve were entirely gone, but aural hallucinations existed, with an intermittent diminution of hearing. The fundus was normal; only the visual field showed that remarkable form (given in Figs. 23 and 24) of an intermittent lessening of excitability.

As this affection is of an eminently chronic character, extending until the sixtieth year of age in a number of persons, and many patients either discontinue treatment or change their physician from impatience, it is difficult to observe the majority of cases during the whole course of the disease. In regard to the **prognosis**, it has to be mentioned, that these conditions may be the preliminary stage of more serious nervous diseases and psychoses. These neurasthenic asthenopic affections generally seem to involve little danger to the structure of the optic nerve, otherwise we would meet, more frequently than is really the case, with serious

complications of the optic nerve in the great majority of these patients. As the excitability of the digestive and sexual organs produces reflex symptoms in other organs, we can only think of healing these conditions, if we are able to remove the etiological moment by local treatment. Therefore, the **treatment** has to be local and constitutional in regard to the existing nervous weakness. Those cases in which the symptoms are the effect of a curable local affection, promise a much more favorable prognosis as to a perfect cure on account of the more precise therapeutic directions. Thus, in case 7, with descensus uteri, all those prominent symptoms disappeared after a colporrhaphy posterior. Only after a cohabitation they returned transiently. The most important therapeutic direction for all those patients is: Avoidance of overwork, bodily and mentally, of all exciting and weakening influences; strengthening of the patient by a regular diet, together with tonics and sedatives. The unfavorable influence of a depressed mind upon the appetite and nervous system is well known, and, if we learn from the history that the outbreak of the disease, being latent until that time, was brought about by such debilitating influences or by sudden fright, we know what kind of treatment we have to choose. In case 10 I could directly observe, in regard to the contraction of the visual field, what an influence these conditions of affect have upon the function of the eye. The young girl sat, trembling from fright (Fig. 10, the visual field with the outdrawn lines), at the perimeter. Therefore, the first drawing shows a much greater defect of the visual field than the second examination, twenty minutes later, after perfect acquiescence of the patient. If the curvature (Fig. 22) indicates how extremely quick the function of the optic nerve diminishes in direct proportion to the asked effort, and if the central acuteness of vision fell from $\frac{20}{30}$ to $\frac{20}{70}$ in consequence of overstraining, in some of my patients, there is objective evidence of the great damage which over-excitement and over-tiring may cause to the nervous system of such patients. One of my patients suffering from tabes, (whose field of vision is represented in fig. 25,) twenty-seven years old, whose left eye was per-

fectly amaurotic and the right eye was improved after staying in the country, so that he could distinguish colors again, had to interrupt his treatment on account of his only child falling ill. When the family physician explained to the parents it was diphtheria and the child's life almost without hope, the visual power of the left eye rapidly diminished, so that he was wholly blind for some hours from fright; gradually he again improved.

Von Graefe says: "In this disease I must warn against taking blood, and all weakening treatment or means which excite the nervous system or disturb the sleep. After this not only immediate deteriorations occur, but an obstinate character of the disease develops itself." In regard to the avoidance of sexual over-excitement and masturbation, it does not suit every physician to extend the anamnestic investigation to this lubric field of human passions; even I consider it as illegitimate from the professional stand-point, to extort confessions of that kind from one's patients. The opposite result will be obtained to that which the physician has to obtain, if the triumph of convincing a patient of masturbation has to be weighed against the obnoxious and depressing influence caused by the moral defeat of a man whose mind was depressed enough before. No matter whether the suspicion is confirmed or not, direct warnings tending to that point will be sure to be easily understood and thankfully accepted by the patient, who, not morally exposed, will not be detained by shame from confidentially applying to his physician again for further relief. If a large number of these patients, even in the morning in getting up, feel tired and exhausted, and every work has to be laid aside from weakness and lack of energy, it would certainly be a wrong measure to increase the weakness by overstraining to exhaustion, recommending motion in fresh air. Nearly all these patients sleep badly. In regard to this we have to combat a very common prejudice, viz.: that an excessive bodily movement is necessary in order to obtain a refreshing sleep. Opium preparations and chloral ought not to be ordered to such patients on account of their abuses and of the fact that nervous persons often

become more excited from the use of opium preparations. Bromide of potassium (5 grammes daily in a cup of an infusion of valeriana) is recommended as an excellent remedy. At the same time patients should frequently rest during the day. In many of my patients sleep returned after the use of large doses of potass. bromide, although the complaints from the visual organ continued. In the same manner, as stimulating and exhilarating influences revive the exhausted action of the nerves, we may aid these conditions by stimulating external and internal means. I have seen the greatest advantage from cold douches upon neck and back and cold rubbing. Chlorotic persons used iron and quinine. Subcutaneous injections of strychnia with a regular diet and ordination of pills of castoreum and valeriana (according to Förster) proved very useful in complaints of the visual organ. Sleep improved, the general health became better, the fog disappeared from the sight, the inclination to work returned, the visual field extended to the normal limits and hardly showed traces of the contraction before mentioned. Some of my patients wholly recovered. In order to obtain good results from strychnia, one must not take too small a dose. I injected daily three-quarters of a syringe of a solution 0.1 to 10.0,[1] without the slightest accident.

These subcutaneous injections were not of the desired effect in two of my patients, as, according to the family physician's statement, an increase of restlessness occurred in a lady with a severe hereditary hysteria, although the ocular symptoms were diminished, and in the other lady no results from strychnia could be obtained. The moderate use of wine is recommended as one of the most beneficial remedies by all, and one of my patients could entirely stop those disagreeable conditions by a glass of claret.

A physician used inhalations of a few drops of nitrite of amyl, in a case where the the vaso-motor disturbances were prominent. The lady complained mostly from disturban-

[1] For an ordinary syringe, containing 1.25 gramme = ʒ i, this would be ¼ gr., almost 0.01, too large a dose to begin with, according to general experience.—Ed.

ces of sight, had visual hallucinations, photopsies, and from time to time, very annoying obscurations of vision, with an increased redness of the face and ciliary injection. The inhalation of a few drops of nitrite of amyl controlled the symptoms at once. The obscurations were, perhaps, brought about by transient slight anæmia of the retina, and subsided after dilalation of the retinal vessels by the inhalation of nitrite of amyl. The same effect was observed by Deutschmann (*Archiv f. Ophth.*, Bd. xxvii, p. 1) in atrophy of the optic nerve. As this remedy causes great congestion of the head, it ought to be used only in those cases where no intra-ocular abnormities exist. In one case of my practice, in which there was a very high degree of myopia, besides very marked symptoms of neurasthenia, with changes of the yellow spot and inclination to repeated hemorrhages in the retina, this remedy was not allowed on account of the vaso-motor character of all the symptoms and tendency to retinal hemorrhages.

A frequent change of remedies is especially to be recommended, as the confidence of the patients in a new medication may help to secure the effect. Many of these patients visit the oculist on account of asthenopic complaints, and after a superficial examination, one is apt to believe to have cured the trouble by prescribing glasses, as in most cases a slight insufficiency of the internal recti muscles is observed. Instead of benefit, we meet with new complaints and troubles, caused by the glasses, which soon are laid aside. The reflex of light from the glasses "dazzles and causes pains in the temples and in the eye." The pressure of the frame upon the nose and temples produces an "intolerable sensation," and the new troubles are so intense as to prevent the patients from the use of the glasses, although they confess that the vision is improved by them. Mooren has found frames of tortoise-shell the most useful in such cases. In order to diminish the dazzling, blue or gray glasses should be used,—according to the feeling of the patient.

Frequent rest should be ordered in a moderately-illuminated and quiet room; reading, needle-work, or piano-playing should not be allowed. Easy work in the house or

garden, taking care of flowers, or any occupation which keeps the patient active without overtaxing his strength, has always been of the greatest advantage. Sea-bathing or iron-baths, in places with good air, woods, and pleasant surroundings, will complete the cure. Beard highly recommends faradization of the whole body, and the galvanic current at the head and vertebral column. I could prove the beneficial influence of this treatment in three of my patients, one of whom called it his "temporary savior." Many patients call on the oculist, frightened by the serious symptoms from the eyes, and upon the assurance that their disease is "merely nervous," they go away without inclination and patience to undergo any further treatment. One will be very much disappointed in believing to have cured the affection permanently by a short treatment with transient success. At short intervals relapses will occur, for a change of symptoms and of locality is a characteristic feature of neurasthenia, although the troubles from the eyes may be relieved for some time. The affection is chronic with an intermittent character.

It is difficult to decide whether these patients belong to the care of the oculist or neuro-pathologist in a specialistic sense, but it may not be easy for the general practitioner and neuro-pathologist to put some incident symptoms, which may easily be taken for serious organic affections of the optic nerve, into the category of merely functional disturbances of the optic nerve, without consulting an ophthalmic surgeon. Beard was accustomed to treat his cases in consultation with a gynæcologist and oculist.

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SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE FIRST QUARTER OF THE YEAR 1883.

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A.—GENERAL OPHTHALMOLOGICAL LITERATURE; GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPEUTICS; NORMAL ANATOMY AND PHYSIOLOGY.

By H. MAGNUS, M.D.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

a.—TEXT-BOOKS, MONOGRAPHS, TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS.

1. Berlin and Rembold. Investigations on the influence of writing on the eyes and attitude of the body of school-children. Stuttgart, 1883.

2. De Chardonnet. La lampe Edison et l' hygiène de la vue. *Acad. d. sci.*, Feb. 19, 1883. Edison's lamp is recommended.

3. Le Conte, Jos. Sight. *Internat. wissensch. Bibl.*, vol. LV, Leipzig, 1883, xii, 26.

4. FIEUZAL. Bulletin de la clinique nationale ophthalmologique de l' hospice des quinze-vingts. Paris, 1883. Tome 1, No. 1. Will be published as a quarterly. The first number contains a report on the history, equipment, and number of patients at the Paris hospital des quinze-vingts.

5. GALEZOWSKI and DAGUENET. Diagnostic et traitement des affections oculaires. Paris, 1883. Baillière et fils, No. 1 contains: Conjunctiva, cornea, sclera, iris. The whole will be published in instalments and be complete in three volumes.

6. JOSTEN. The provincial ophthalmic institute at Münster. *Klin. Monatsbl. f. Augenheilk.* Description of the newly-erected institute, with a design of the ground-plan.

7. M. REICH. Ophthalmic report of the Caucasian military district for 1880 and 1881. *Wojénno-Medicinsky Journ.*, Nov. and Dec., 1882.

8. SCHUBERT. The text-books used in the schools of Nuremberg from an ophthalmic point of view. Rep. of the Sanitary Soc. of Nuremberg, No. 5. Schubert endeavors to formulate the scientific demands upon a book, and tests the school-books of the city from an ophthalmic point of view.

9. WEBER. A new era in the hygiene of the schools of the Grand Duchy of Hessen. *Klin. Monatsbl. f Augenheilk.* See *antea.*

BERLIN and REMBOLD (1) come to the following conclusions:

The present slanting system of penmanship should be retained.

The following rules should be adopted in the schools:

1. The inclination of the letters—*i. e.*, the angle which the downward stroke makes with a line perpendicular to the ruling of the paper—should be 35°–40°.

2. The book should not be placed to the right, but as nearly as possible before the median line of the body, and so inclined that the direction of the writing rises from the left and below to the right and upward at an angle of 30°–40°. When in the proper position the downward stroke is perpendicular to the table's edge, and the centre of the line just being written opposite the median line of the body.

3. The position of the body essentially corresponds to the rules laid down in § 2 of the ordinance of 1868, to which only a few additions need be made, so that the sections of this paragraph

reads as follows: (*a*) The upper part of the body remains upright as far as possible, so that it is supported by the spinal column, which is prevented from becoming tired by resting its lower portion against a support. (*b*) The transverse axis of the body, the connecting line between the shoulders, is parallel to the longer edge of the table, and an oblique position of the upper part of the body is therefore not justifiable, as is recommended by some teachers for the acquisition of a neat, slanting style of writing. (*c*) The body must not be pressed against the edge of the table, but kept at a distance of about 3 *cm.* from it. (*a*) The head, whose transverse axis is also parallel to the longer edge of the table, is lowered but slightly toward the latter, and not more than is necessary to obtain a suitable angle between the visual plane and the surface of the table. (*e*) The elbows must be kept a little lower than the edge of the table and at an equal distance from the body; this distance should be neither too great nor too small, but has a certain margin within which it depends upon the height of the shoulder above the edge of the table. (*f*) The forearms, not the elbows, are laid upon the table in an almost symmetrical position, the book being placed in the median line of the body. (*g*) The position of the feet is the same as in the original rules.

4. This position of the body is to be maintained during the whole act of writing, the upper part of the body and the upper arms to the point of support of the forearms upon the table's edge remaining quiet, and the hand and forearm alone performing the act of writing. In regard to the latter the following directions should be observed: (*a*) The movements necessary to produce the letters and single words must be performed by the joints of the fingers and the wrist. (*b*) The right forearm must not move its point of support upon the table's edge outward as the writing advances along the line, but must revolve about it as a centre, thus describing an arc upon the table. The anterior portion of the hand would thus describe an arc with a long radius, the ruling forming the chord, so that in order to keep the writing in a straight line, the distance of the anterior portion of the hand from the point of support must be slightly increased as the centre of the line is approached, and then again gradually diminished. This diminution should not be produced by withdrawing the forearm, but by a slight bending on the finger-joints and wrist. In order to facilitate adherence to these directions, it is advisable, especially in smaller children, to shorten the lines.

(*c*) When a new line is begun, the forearm must describe the same arc backward with greater rapidity. As the distance between the anterior portion of the hand and the point of support of the elbow diminishes, the more lines are written ; this decrease should be counteracted, not by withdrawing the forearm, but by bending the wrist and finger-joints, and when this is no longer possible, by withdrawing the book with the left hand. This latter motion of the left hand must not be performed by changing the point of support of the left forearm upon the table's edge, but either by a movement of the wrist or a slight rotation of the left forearm about its point of support.

5. The head also must not change its position ; the slight rotation from left to right in writing is not injurious.

III. The school-board and teachers should sufficiently understand the necessity and importance of these directions, so as to enforce them with the proper intelligence and energy. The best means to accomplish this would seem to be the embodiment of a short abstract of Berlin and Rembold's report in the regulations of writing.

IV. In view of the deleterious consequences of a too close approach of the eyes in writing, and the fact that in the youngest children this is the case to a very high degree, producing most unfortunate results, which for anatomical reasons cannot be obviated by changing the regulations, the following suggestions are made :

1. Reading and writing, playing with small objects, in general work requiring close vision, should be forbidden in the schools for younger children, the Kindergartens, etc. ; whence the children frequently enter school with eyes already myopic.

2. Instruction in writing should be limited as much as possible the first year ; reading of distant objects (black-board) should first be taught, then of books, and finally, writing, the time not extending beyond half an hour the first years, and limited to 5–10 minutes, followed by a pause of a few minutes.

3. The letters should be large, symmetry and beauty being of less importance.

4. The slanting lines of the black-boards and books should be omitted.

5. Writing, especially at home, should be limited as much as possible, and permitted only when the child's home is sufficiently light and airy.

5. The teachers should impress the children with the importance of assuming the correct attitude when writing at home. Instruction of the parents on this subject would also be desirable.

CONTE (3) intends to publish a book which will prove equally valuable to the layman and specialist. The greater part of it is devoted to the laws of binocular vision, and as he discusses in detail various doubtful questions, the book will undoubtedly prove useful.

REICH (7) discusses, in his very minute report, circulars and orders in regard to the prevention of ocular affections and epidemics in the army, and the reports on the condition of the soldiers' eyes of the Caucasian district; he also minutely describes the Caucasian hospitals which have ophthalmic wards. There are three such hospitals in the Caucasus: the first Tiflis Hospital and the hospitals at Kars and Wladikawkas. In 1881 ophthalmic wards were also established in the hospital at Karakliss. In the three hospitals named above, 1,200 (including out-door patients) were treated and 155 operations performed (in 1880 only 70). The report contains a very detailed schedule of all the ocular affections in the different regiments and military divisions, with a reference to the hygienic conditions; reports on the number of trachoma-patients; on the state of refraction of the pupils of the military schools; on the vision of the soldiers of the Caucasian district (23,292 men); on the number of the blind and the causes of blindness. HIRSCHMANN.

b.—STATISTICAL PAPERS.

10. ALEXANDER. Fourth report of the ophthalmic institute of the district of Aachen. Aachen, 1883. 2,025 new patients.

11. J. J. CHISOLM. Fifth annual report of the Presbyterian Eye and Ear Charity Hospital. 3,229 eye-patients; 53 extractions according to v. Graefe, 48 iridectomies, 99 squint-operations, 31 enucleations, 4 neurotomies. BURNETT.

12. GLEIWITZ. Second annual report of the directors of the society for supporting the Gleiwitz Eye and Ear Hospital, Oct. 1, 1881, to Sept. 31, 1882. 1,889 patients; 99 operations.

13. HALTENHOFF. Troisième rapport de la clinique ophthalmique du Molard. Geneva, 1883.

14. HIRSCHBERG. Annual report for 1882 of Prof. Hirsch-

berg's ophthalmic institute. 7,478 patients; 341 important operations, 46 extractions (two of them failures).

15. JANY. Eighteenth annual report, for 1882, of Dr. Jany's ophthalmic institute at Breslau. Breslau, 1883.

16. MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY. Fifty-seventh annual report for the year 1882. Boston, 1883.

17. PFLÜGER. Annual report of the ophthalmic clinic of Berne University for 1881. Berne, 1883.

In 1882 JANY (15) treated 3,507 new patients; total number, 56,737. Sixty extractions, according to v. Graefe, were performed, one of them being a failure and eight moderate results. Total number of operations on the lens, 114. Two cysticerci were extracted from the vitreous; in one case a chip of iron was removed from the vitreous with an electro-magnet. A short discussion on blindness in Prussia precedes the report.

In the Massachusetts Infirmary (16) 7,185 new patients were treated in 1882; 84 senile cataracts were operated according to v. Graefe. These extractions are minutely discussed in a statistical table. The 7,185 diseases are distributed as follows: lids, 645; conjunctiva, 1,883; cornea and selera, 1,504; iris and ciliary body, 307; choroid, 158; retina, 40; optic nerve, 66; vitreous, 21; lens, 276; injuries, 86; amblyopia, 89; refraction and accommodation, 845; muscles and nerves, 227; lachrymal apparatus, 235.

In Berne (17) 1,036 patients were treated in the dispensary, and 302 operations were performed: 40 frontal extractions, 9 of them in the capsule; no failure. Antiseptic treatment was adopted, for operations: 1 % carbolic, with 4 % boracic, acid. The same solution was used for cleansing before the operation. It was also used in cases of injury. Pflüger is opposed to Credé's prophylactic method of treatment of blennorrhœa, and believes that unfavorable results will soon be reported. The reviewer does not share this view, uniform success having been reported thus far. Of the large number of clinical histories one is especially interesting, it being the genealogy of a family in which hemeralopia, combined with a high degree of myopia, is hereditary. The same law which has been shown to hold good in red-green blindness is always followed here, every other generation being affected.

II.—GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPEUTICS.

a.—GENERAL PATHOLOGY AND DIAGNOSIS.

18. v. CHEUVREUL. Précis historique et pratique de l' examen de l' œil et de la vision. Paris, 1883, Masson.

19. v. JAEGER. The diagnosis of diseases of the blood with the ophthalmoscope. *Wiener med. Wochenschr.*, 1883, No. 9.

20. v. KARWAT. Contributions to the affections of the eye in atheroma of the carotid. Inaug. Diss., Würzburg, 1883.

21. SCHMIDT-RIMPLER. Contribution to the knowledge of some results of contusion of the globe. *Arch. f. Augenheilk.*, vol. xii, 2.

According to KARWAT (20) the nutrition of the lens is impaired in atheroma of the carotid, a circumstance which materially favors the development of cataract. Embolism of the central retinal artery may also result.

SCHMIDT-RIMPLER (21) reports some very instructive clinical cases, and calls especial attention to the fact that contusions of the globe result in pathological changes at the macula which cause marked visual disturbances. This disposes of Berlin's explanation, according to which they are due to irregular astigmatism of the lens.

b.—THERAPEUTICS.

22. ABADIE. On accidents immediately after cataract-extraction. *Soc. française d' ophth.*, Jan., 1883 ; *Rec. d' ophth.*, Feb.

23. ANDREW. Extraction of the lens in the capsule. *Brit. Med. Journ.*, Jan., 1883.

24. CHAVERNAC. Extraction de la cataracte. Retour de la méthode de Daviel. *Ann. d' ocul.*, 1883, i.

25. COWELL. On certain modifications of A. v. Graefe's linear extraction. *Brit. Med. Journ.*, Jan., 1883.

26. GALEZOWSKI. On extraction of cataract with or without excision of the iris. *Soc. franç. d' ophth.*, Jan., 1883 ; *Rec. d' ophth.*, Feb., and *Lancet*, No. 3.

27. HIRSCHBERG, J. On extraction of chips of iron from the interior of the eye with the magnet. Gessellsch. d. Charitéaerzte, Jan. 4, 1883. *Centralbl. f. prakt. Augenheilk.* ; *Berl. klin. Wochenshr.*, No. 5.

28. HOLSTEIN. Antiseptics in ophthalmology. Inaug. Dissert., Berlin, 1883.

29. E. G. Loring. Premature delivery for the prevention of blindness. *N. Y. Med. Journ.*, Jan. 20, 1883.

30. Montaldo. Los antisepticos en oftalmologia. *Buletina de medicina naval*, Cadiz, Jan., 1883.

31. Snell. On extraction of cataract by a shallow lower flap. *Brit. Med. Journ.*, Jan. 13, 1883.

32. Terson. On means for preventing suppuration of the corneal wound after extraction in dacryocysto-blennorrhœa. *Soc. franç. d' ophth.*, Jan., 1883 ; *Rec. d' ophth.*, Feb.

33. De Wecker. Quelques perfectionnements apportés à l' extraction de la cataracte. Gand, 1883. Abstract of an article in the Nov.-Dec. No., 1882, of the *Ann. d' ocul.*

34. Wicherkiewicz. The technique of iridectomy. *Centralbl. f. prakt. Augenheilk.*

Abadie (22) distinguishes two kinds of accidents after cataract-extraction, those which immediately follow the operation and those which manifest themselves later.

Andrew (23) prefers Macnamara's method of forming a large temporal flap under narcosis and extracting the lens with a spoon. In some cases iridectomy also is performed, especially when the pupil cannot be sufficiently dilated.

According to Cowell (25) the best results are obtained with v. Graefe's method, modified as follows: 1. The pupil is dilated in the morning; 2, anæsthetics are always administered ; 3, the section lies in the cornea, but very peripheric in order to be subconjunctival.

Galezowski (26) recommends extraction without excision of the iris, as inflammation can then be more easily avoided.

Holstein (28) criticizes the various reports on antiseptics in ophthalmology, and comes to the following conclusions: 1. The great danger of septicæmia which threatens the body after severe surgical operations need not be feared in ophthalmology, as the intra-ocular pressure and firm fibrous envelopes of the globe make septicæmic infection of the body very difficult. Therefore antiseptic treatment is unnecessary. 2. The serpent ulcer, dacryocystoblennorrhœa, and the specifically infectious conjunctival blennorrhœas should be treated with antiseptics on account of their septic nature. 3. The strict antiseptic bandage according to Lister cannot be applied to the eye, as it is not practical, irritates on ac-

count of the concentration of the solutions of carbolic acid, and especially as the eye is in anatomical connection with the cavities of the mouth and nose. The spray also should be discarded, as its power to destroy bacteria is doubtful, and because it produces irritation and befogs the field of operation. 4. Antiseptic treatment, as practised thus far in ophthalmology, has at times given good results. But it gives no reliable protection either, as a large number of losses may occur in rapid succession. Boracic acid has thus far proven the best antiseptic, as it does not irritate and still disinfects; for disinfecting the instruments, absolute alcohol and benzoate of sodium. Equally good results are obtained by the separation of materials (?—ED.) and scrupulous cleanliness in an aseptic institution, so that it must be ranked as at least equal to the antiseptic treatment.

LORING (29), in an elaborate paper, advises premature delivery, not only in those cases in which albuminuria accompanied by retinitis has been shown to exist, but also in all those cases in which diminution of vision during pregnancy is plainly marked. He cites a case from his own practice in which the result was good; he also reports cases of other authors. BURNETT.

TERSON (32) makes the incision downward in dacryocystoblennorrhœa, and injects boracic acid (4 %) into the tear-ducts.

In making an iridectomy for optical purposes, WICHERKIEWICZ (34) seizes the iris with a blunt silver hook when he wants a small coloboma.

III.—INSTRUMENTS AND REMEDIES.

a.—INSTRUMENTS AND TECHNICAL AIDS.

35. BADAL. Verres périscopiques et cônes de Steinheil. *Ann d' ocul.*, Jan. and Feb., 1883. General remarks.

36. COURSSERANT. Nouvel ophthalmoscope à deux observateurs. *Soc. franç. d' ophth.*, Jan., 1883; *Rec. d' ophth.*, Feb., 1883.

37. DESPAGNET has put together a small pocket-case for the oculist; it is made by Mariand, Paris. CHIBRET showed it to the soc. franç. d' ophth. MARCKWORT.

38. HIRSCHBERG. Fixed keratoscope. *Centralb. f. prakt. Augenheilk.*, Jan., 1883.

39. JAVAL. Troisième contribution à l' ophthalmométrie.

Description de quelques images kératoscopiques. *Ann. d' ocul.*, Jan.–Feb., 1883; *Soc. franç. d' ophth.*, Jan., 1883. The method of measuring the cornea resembles that of Placido.

40. KLAUNIG. The artificial eye. Leipzig, 1883, vol. vi, p. 58. *Vid.* also KLAUNIG, on glass eyes. *Med. Jahrb.*, vol. cxcii, No. 2.

41. LANDOLT. Ophthalmo-dynamomètre. *Soc. franç. d' ophth.*, Jan., 1883; *Rec. d' ophth.*, Feb., 1883. Measures the breadth of accommodation and convergence.

42. MORTAIS. On strabismus-spectacles. *Soc. franç. d' ophth.*, Jan., 1883; *Rec. d' ophth.*, Feb., 1883.

43. SCHMIDT-RIMPLER. Determination of refraction in the inverted image. *Zeitschr. f. Instrumentenkunde*, November, 1883.

44. STÖBER. Echelle pour déterminer la simulation de l' amaurose unilatérale et l' acuité visuelle. *Arch. d' ophth.*, vol. iii, 3.

COURSSERANT (36) demonstrates an ophthalmoscope for two observers, constructed by Nachet; it depends upon the fact that platinized glass partly reflects incident rays, partly allows them to pass through. MARCKWORT.

KLAUNIG (40), in an elaborate paper, has touched upon all points in regard to the artificial eye which are of interest to the physician and patient. It is well worth reading.

MORTAIS (42) prescribes strabismus-spectacles immediately after the operation. The good eye remains closed. According to the degree of strabismus, the position of the vertical slit varies.

In determining refraction in the inverted image, SCHMIDT-RIMPLER (43) proceeds upon the following principle: If a concave mirror of moderate focal length (about 5 inches) is used in examining by the indirect method, its inverted and smaller image, which generally lies between the lens and ophthalmoscope, forms the source of light for the fundus. This image must form another bright and distinct one upon the retina of the eye examined, and be visible with the ophthalmoscope when the retina lies in the conjugate focus of the first image—in other words, when the refraction of the eye corresponds to the position of the second image; otherwise it is indistinct. By approaching and withdraw-

ing the mirror, the image formed at its relative focus can be produced at varying distances from the lens held before the eye, and determine the one which corresponds to the refraction of the eye. A well-defined image of the flame will then be seen upon the retina. In order, then, to determine the refraction of the eye, it is only necessary to know the distance of the first image from the convex lens in this position of the mirror. This is given when the distance of the mirror from the lens and the relative focal length of the mirror are known; the latter deducted from the former gives the distance of the image from the lens. Both values can easily be found by measurement. When the lens is held at a distance from the eye equal to its principal focal length, the refraction can readily be determined from the formula $\frac{f^2}{n}$ (where f represents the focal length of the convex lens, and n the difference between the position of the image [B] and the principal focal length). No calculation, however, is necessary if a convex lens of 10 D is used and held at a distance of 10 *cm.* from the eye; every centimetre difference between the focal length of this lens and the position of the image represents one dioptry. If B, measured in *cm.*, is greater than 10, there is hypermetropia; if less, myopia. For instance: if B = 12, there is H 2 D (*i. e.*, 12–10); or if B = 8, there is M 2 D (10–8); or if B = 10, there is E. In order to judge of the clearness of the retinal image with greater accuracy, Schmidt-Rimpler replaces the ordinary light of the lamp by a bright object divided by fine lines. A piece of netting is used for this purpose. Schmidt-Rimpler has constructed a special instrument for making the measurements and holding the lens, which can be obtained from Holzhauer, in Marburg.

STÖBER's (44) plate consists of a number of squares of red and green glass of various sizes, on which test-types (Monoyer's) are pasted. A spectacle-frame containing a red and a green glass is placed before the eyes of the simulant, and if he reads both red and green types, his attempt to deceive is apparent and his vision about determined. (This test was described by Snellen in *Zeh. klin. Monatsbl.*, several years previously.—ED.)

b.—REMEDIES.

45. CHISOLM. Bromide of ethyl, the most perfect anæsthetic for short, painful surgical operations. *Maryland Med. Journ.*, Jan. 1, 1883.

46. LEWIN. Boracic acid and its uses in practical medicine. Inaug. Dissert., Bonn, 1883.

47. DAVID WEBSTER. Sulphide of calcium in ocular affections. *Arch. of Med.*, Feb., 1883.

According to CHISOLM (45), bromide of ethyl is only desirable for a short narcosis, which can be produced in a minute, but only lasts 2–3. It is therefore not adapted for larger operations, like enucleation, extraction, etc. It does not produce nausea.

LEWIN (46) recommends boracic acid, which was introduced by Graefe into ophthalmology, for bandaging after extractions, and in those cases of conjunctival catarrh in which the secretion shows a tendency to coagulate. Boracic acid should be used when nitrate of silver is contra-indicated, and carbolic acid cannot be used as it affects the cornea. It is especially effective in so-called atropine-conjunctivitis.

WEBSTER (47) has employed sulphide of calcium in certain ocular affections, and claims good results in the so-called scrofulous (strumous) inflammations, like phlyctenular keratitis and conjunctivitis, corneal ulcers, ulcers with hypopyon, kerato-iritis with hypopyon, episcleritis, interstitial keratitis, etc. He usually gives a dose of $\frac{1}{10}$ of a grain (0.006) four times daily.

BURNETT.

IV.—ANATOMY.

a.—GENERAL ANATOMY.

48. BENDALL. The preparation of the tissues of the eye for microscopical examination. *Ophth. Rev.*, March, 1883.

49. HÖLTZKE. Microphthalmus and coloboma in a rabbit. *Arch. f. Augenheilk.*, vol. xii, 2; these ARCH., vol. xii, p.

50. SMITH. Modes of preserving and coloring ophthalmic specimens. *Ophth. Rev.*, March, 1883.

b.—LIDS, CONJUNCTIVA, CORNEA, LACHRYMAL APPARATUS.

51. DENISSENKO. Investigations on the nutrition of the cornea. *Wratschebnyja Wjedomosti*, 1883, Nos. 9–12.

52. RETTERER. Sur la génération des cellules, le renouvellement de l' épiderme et des produits epithéliaux. *Communication à l' académie des sciences*, Feb. 13, 1883.

After a close analysis both of his own observations and those

of others, DENISSENKO (51) comes to the following conclusions: (1) The cornea is not nourished from the anterior chamber, but by the surrounding blood-vessels in the sclera. (2) The nourishing liquid is conducted in the vessels through the fibre-bundles and fissures of the sclera to the corneal margin, where it is distributed throughout the entire thickness of the cornea by means of the lacunæ and fissures, and finally is discharged into the anterior chamber. (3) The current in the cornea moves from the periphery toward the centre and from the surface toward the interior. (4) The stomata of the epithelium of Descemet's membrane also serve to discharge the liquid, which has served its purpose. (5) The anterior chamber is an enlarged duct for discharging the lymph-vessels of the cornea. (6) In Bright's disease, the œdema of the cornea is mainly due to a closure of its ducts opening into the anterior chamber. (7) When Schlemm's canal is closed (on account of swelling) the cornea is also thickened; its spaces are distended with liquid, while their physiological form remains unchanged, and if Schlemm's canal again becomes permeable, the cornea also returns to its normal condition. In morbus Brightii the œdema is more marked; the distended spaces tear and form larger cavities. The cornea loses its shape in consequence, and returns to the condition with great difficulty. (8) The physiological theory of the cause of œdema (Magendie, Cohnheim, Lichtheim) does not explain the œdema of the cornea; the theories of Ranvier and Roth, however, are satisfactory. (9) The dimness of the fundus and the reduction of vision must not be referred to retinal changes only, but also to pathological changes of the cornea. (10) The detachment of the endothelium in metastatic irido-choroiditis is due to an accumulation of liquid between the elastic membranes and the endothelium. (11) The cells of Descemet's membrane may contribute to the increase of the hypopyon, but do not cause it. (12) In the horse and other animals, whose retinæ contain no blood-vessels, the retina is nourished as in birds.

HIRSCHMANN.

c.—VITREOUS AND LENS.

53. BAYER. On the visible canal of Cloquet in the human eye. Verein deutscher Aerzte in Prag., Jan. 19, 1883. *Wiener med. Presse*, No. 5.

54. O. BECKER. On the vortex and nuclear arch in the human lens. *Arch. f. Augenheilk.*, vol. xii, 2; these ARCH., vol. xii, p. 169.

55. DESSAUER. The question of the zonula. *Klin. Monatsbl. f. Augenheilk.*

56. HOCQUARD et ALB. MASSON. Étude sur les rapports, la forme et le mode de suspension du cristallin à l' état physiologique. *Arch d' ophth.*, vol. xii, 3.

57. PRIESTLEY SMITH. Growth of the crystalline lens. *Ophth. Soc. of the Unit. Kingd.*, Jan. 11, 1883. *Lancet* No. 3; *Brit. Med. Journ.*, Jan. 20, 1883.

According to DESSAUER (55) the zonula closely applies to the flat portion of the ciliary body and to the ciliary processes, and presents an exact impression of the latter when carefully removed. In the new-born and adult the zonula has no connection with the hyaloid membrane. There are no regularly arranged cells or nuclei, which would indicate the existence of an endothelial layer upon the zonula. Spaces may exist between the zonula and vitreous, but not between the zonula and ciliary processes.

According to the investigations of HOCQUARD and MASSON (56) the zonula consists of a system of fibres entirely independent of each other; these are joined by supporting fibres as they pass forward, which spring from the pars cil. ret. and pass obliquely from in front backward, and *vice versâ*. Thus a net-work is formed, held distended by the ciliary processes, which impress themselves upon it like fingers upon a stretched net. The fibres of the zonula are formed of fibrils which spring from (1) the hyaloid membrane, (2) the ora serrata, (3) the basal membrane of the pars cil. retin. This structure of the zonula excludes the existence of Petit's canal, but increases the size of the posterior chamber, extending it to the ora serrata. During accommodation the zonula, whose different bands can move upon the hyaloid membrane, is slackened by the advance of the choroid and fixed in its new position by the ciliary processes, which are pressed against the sclera by a peculiar muscular apparatus, which thus far has been considered a circular muscle, but which produces the opposite effect, and in this respect and in its arrangement corresponds to the interscleral fibre-bundle of the ciliary muscle of the chicken.

v. MITTELSTÄDT.

According to SMITH (57) the mean weight of the lens increases every year about 1.5 milligrammes, the mean volume about 1.5 cubic millimetres. This continuous growth of the lens explains the peculiar optical changes of the eye as age comes on, and the

senile shallowness of the anterior chamber. The continuous growth of the lens results from the epidermoid structure of the substance of the lens enclosed in the capsule.

d.—RETINA AND CHOROID.

58. BOUCHERON. De l' épithelium aquipare et vitréipare des procès ciliaires. *Soc. franç. d' ophth.*, 1883. *Rec. d' ophth.*, Feb. 1883.

59. GOLDZIEHER. Contributions to the normal and pathological anatomy of the choroid. 1. The nerves of the suprachoroid. *Centralbl f. prakt. Augenheilk.*

60. OSTWALST. Experimental investigations of the central reflex of the retinal blood-vessels. *Centralbl. f. prakt. Augenheilk.*

The outermost layer of the choroid (59) must be considered as a nerve-layer, on account of the great number of nerves and ganglia ; it is the common sheath for all the nerves within it. The nerves directly enter the stellate pigment-cells. In the anterior portion of the suprachoroid the fibres spread out in a peculiar manner and form discs, which are especially numerous near the ciliary muscle. The two long posterior ciliary arteries have their own nervous apparatus.

e.—OPTIC NERVE AND CENTRAL ORGANS.

61. BECHTEREFF. Experimental investigation of the decussation of the optic-nerve fibres in the chiasm. *Klinikscheskaja gazeta*, 1883, Nos. 2 and 3 ; *Neurol. Centralbl.*

62. LUYS. A l' etude de la physiologie et de la pathologie des couches optiques. *L' Encéphale*, vol. ii, 3.

BECHTEREFF's (61) experiments of dividing an optic tract, or the chiasm in a sagittal plane from in front backward were performed on dogs according to two methods : he either entered with a double-edged knife from the pharynx into the cranial cavity in the region of the sella turcica, cutting either an optic tract or the whole chiasm in a sagittal plane, or he trephined the skull just above the zygomatic arch, between the eye and ear, and then passed along the inner surface of the middle cerebral cavity to the lateral wall of the sella turcica with a curved knife blunt at the tip, and cut the optic tract. The first method is more difficult ; in the other the adjacent parts are easily injured.

He obtained the following results : If the optic nerve of one

side is cut, complete blindness of that eye ensues; the primary reaction of the pupil to light is lost, while the consensual reaction is preserved. When the chiasm is cut in a sagittal plane the animal does not become totally blind in either eye. The primary and secondary reaction to light are both preserved. When an optic tractus is cut neither eye becomes totally blind, and when both eyes are open the animal avoids every obstruction. If one eye, however, is bandaged, it constantly collides with obstructions lying toward the uninjured side. The limitation of the field of vision toward one side can be demonstrated for both eyes (toward the uninjured side). The defect in the visual field seems to be equal to an entire half of each retina. The primary and secondary reactions for light are preserved. The pupils are of equal width. There is therefore semi-decussation in dogs in accord with Gudden's statements. The centripetal fibres which conduct the reaction of the pupils for light, do not pass through the tractus, but enter the brain and then the oculomotor nuclei directly after reaching the chiasm. HIRSCHMANN.

V.—PHYSIOLOGY.

a.—GENERAL PHYSIOLOGY.

63. AXENFELD. An optical phenomenon which might be utilized in constructing an optometer. *Arch. f. d. ges. Physiol.* vol. xxx.

64. MAUTHNER. The influence of the electric light on the human eye. *Allg. Wien. med. Zeitung*, 1883, No. 10.

65. MATTHIESEN. On the shape of infinitely thin astigmatic pencils of light and Kummer's models. *Sitzungsber. d. math. phys. Classe d. Kön. bayr. Acad. d. Wissensch.*, 1883, No. 1; *Klin. Monatsbl. f. Augenhlk.*

66. ULRICH. Contribution to the investigations on the interchange of liquids in the eye by means of injections of fluorescin. *Arch. f. Augenheilk.*, vol. xii, 2. These ARCHIVES, this number.

67. URBANTSCHITSCH. The influence of irritation of the trigeminus on the senses, especially sight. *Arch. f. d. ges. Phys.* vol. xxx.

According to MAUTHNER (64) the electric light increases vision and color-perception. The arc-light is not steady, and therefore injurious; the incandescent light is steady, and theoretically no

objection can be made to it, but experience alone can decide as to its value.

b.—CORNEA, IRIS, AND REFRACTIVE MEDIA.

68. KAZAUROW. The influence of accommodation on the boundary of the visual field. *Wratsch*, 1883, No. 2.

69. MOELI. Remarks on examining the width of the pupil. *Berl. klin. Wochenschr.*, No. 6.

KAZAUROW (68) has found that the field of vision is enlarged by accommodation by an advance of the retina and choroid and the pupillary area, and in an aphakic eye by an advance of the choroid and retina only. The smaller size of the pupil only slightly diminishes this effect. HIRSCHMANN.

c.—RETINA AND CENTRAL ORGANS.

70. BECHTEREFF. The function of the optic thalami. *Wratsch*, 1883, Nos. 4 and 5 ; *Neurol. Centralbl.*

71. CHARPENTIER. Expériences relatives à l' influence de l' éclairage sur l' acuité visuelle. *Arch. d' ophth.*, vol. iii, 1.

72. M. LANDESBERG. Is mechanical iritation of the optic nerve always followed by a sensation of light? *Med. Times*, Feb. 24, 1883.

73. PLACIDO. Physiologia do punctum cœcum da retina humana. Porto, 1883, and *Centralbl. f. prakt. Augenheilk.*, p. 121.

74. SAKEWITSCH. A few cases of extraordinary acuteness of vision. *Wratsch*, 1883, No. 1.

75. STÖBER. Du champ visuel simple ou achromatique et de ses anomalies. *Arch. d' ophth.*, vol. iii, 1–3.

BECHTEREFF (70) concludes from his experiments, which consisted in irritating as well as destroying certain parts of the optic thalami of various animals, both before and after removing the hemispheres, that in higher animals (dog) the destruction of the anterior, middle, or posterior portion of this ganglion affects sight. When the anterior portion is destroyed, the visual disturbance is no longer perceptible after a few days. When the posterior portions are destroyed, however, lasting hemianopsia results, clearly proving semi-decussation. The reports of various authors of the influence of the optic thalami on the reaction of the pupil, forced movements and disturbances of the equilibrium, he ascribes to injuries of the neighboring parts during the experiments. He also

denies that the optic thalami have any influence upon sensibility. Neither has he observed any motor paralysis. The author proves by his experiments that the optic thalami contain the centres of involuntary innervation of those muscles which give expression to the various emotions, varying according to the nature of the animal. These ganglia, therefore, mainly control the so-called expressive utterances and the movements. The corpora quadrigemina, however, which are considered the centres controlling the expression of sensations and feeling by modern authors, have no influence in this respect. HIRSCHMANN.

CHARPENTIER (71) illustrates by a number of curves the influence of illumination on the acuteness of vision. He fastened two black pasteboard discs, from which sectors had been excised, in such a manner above each other that the sectors more or less covered each other. The discs were then set in rotation before the eye, and the distance measured at which the test-object was recognized. The intensity of illumination could readily be determined from the extent to which the sectors overlapped each other. The author used for these experiments a lamp whose intensity could be regulated, and his differential ophthalmometer described in the *Arch. d' ophth.*, vol. ii, No. 5. v. MITTELSTÄDT.

LANDESBERG (72) concludes from a number of observations—seventeen in all—that mechanical irritation of the optic nerve causes pain in some cases, but only occasionally a sensation of light. BURNETT.

According to the investigations of PLACIDO (73), the filling up of the area of the blind spot is a real physiological fact, the cause lying in the retina. The entrance of the optic nerve is surrounded by a peculiar retinal zone, the irritation of which does not produce the sensation of a ring, but of a uniformly illuminated disc. As soon, however, as the objective ring of light is moved in the visual field, it at once assumes the shape of a ring. Probably the surface of the retina in this peripapillary ring has a shape differing from the remainder of the retina; it gradually curves toward the centre of the globe. Taking into consideration the principle of projection, it is found that the normals of this ring fill the whole area in the visual field corresponding to the papilla.

SAKEWITSCH (74) found among the soldiers of the 14th regiment of Russian dragoons two cases with $V = \frac{8}{10}$, three with $V = \frac{7}{10}$, and seventeen with $V = \frac{6}{10}$.

STÖBER (75) has constructed a number of charts for pathological fields of vision, and furnishes the proofs for them from observations by himself and other authors of diseases of the optic nerve, the retina, and choroid, calling attention at the same time to the value of perimetry in etiology and prognosis.

V. MITTELSTÄDT.

d.—COLOR-PERCEPTION.

76. DE CHARDENNET. Vision des radiations ultra-violettes. *Compt. rend. hebd. des séances de l' acad.*, No. 8. The retina is capable of perceiving the ultra-violet rays, but the lens absorbs them.

77. CHARPENTIER. Perception des couleurs à la périphérie de la rétine. *Arch d' ophth.*, vol. iii, 3.

78. CHEVREUL. Memoire sur la vision des couleurs matérielles en mouvement de rotation. *Compt. rend. hebd. des séances de l' acad.*, No. 23.

79. CROCKER. Lessons on color in primary schools. Boston, 1883. Recommends the color-chart of Magnus ; edited in English by Jeffries.

80. HIRSCHLER. Erythropsia in aphakic eyes. *Wiener med. Wochenschr.*, 1883, Nos. 4–6.

81. KÖNIG. The neutral point in the spectrum of the color-blind. The point of intersection of the curves representing the intensity of the three primary colors in the normal eye. *Physik. Gesellsch. in Berlin*, March 14, 1883.

82. LAURENT. Du Daltonisme : étiologie, fréquence, danger. Thèse, 1883.

83. LAYET Du Daltonisme. Nécessité d' une éducation du sens des couleurs chez les écoliers. *Gaz. hebd. des sci. méd. de Bordeaux*, Jan. 7, 1883.

84. MARI. La santonina e la visione dei colori. *Ann. d' ottalm.*, vol. xi, 6.

85. OLE BULL. Chromatoptometric plate. Christiania, 1883.

86. ROSENSTIEHL. De la sensation du blanc et des couleurs complémentaires. *Rev. clin. oculist.*, vol. iv, 1.

87. SCHASLER. The world of colors. A new attempt to explain the origin and nature of the colors, with some practical advice for discovering the laws of harmonious combinations. Collection of popular scientific lectures, published by Virchow and

v. Holtzendorff, Berlin, 1883. No. 409 and 410, first section : the relation of the colors to each other and to the eye. No 415, second section : the law of the harmony of colors and its application to the industrial arts.

88. R. W. SHUFELDT. A case of Daltonism in one eye only. *Med. Rec.*, March 24, 1883.

CHARPENTIER (77) tested the sensibility for colors of the periphery of the retina with Landoldt's perimeter. A minute electric light was the source of illumination, before which colored glasses were successively placed. It was found that in the periphery also colors are perceived when sufficiently intense ; the colored surface need therefore not be large, as the experiments were made with mere points of colored light. v. MITTELSTÄDT.

As the intensity increases, the neutral point (81) moves in the same person toward the blue end of the spectrum. An examination of ten persons showed that the colors at the neutral point gradually merge into each other.

LAYET (83) demands that the color-sense of children should be trained, and recommends Holmgren's method and the colored plates of Magnus for this purpose. MARCKWORT.

According to MARI (84) forty centigrammes of the drug are sufficient to produce an effect lasting twelve hours. Bright surfaces appear greenish-yellow ; dark ones, especially shadows, violet. Red assumes a purple tinge, yellow seems pale, blue has a greenish tinge, violet and purple become darker, orange seems pink, greenish-yellow is changed to gray. The spectrum is shortened, especially at the violet end. In a violet-blind person the whole spectrum was displaced. DANTONE.

OLE BULL (85) has obtained ten shades of the primary colors, red, yellow, green, and blue, by mixing them with gray, whose relative intensity would then be expressed by the numbers 1.15, 2, 4, 6, 8, 11, 14, and 18, 1 representing the palest shade. When this palest shade is recognized at a distance of 1 metre, C (color-perception) of the person tested $= \frac{1}{1}$; but if it were the sixth shade, for instance, $C = \frac{1}{6}$.

SCHASLER (87) puts himself into direct opposition to the present theories of colors in a polemic manner which scarcely can be approved of. The main idea seems to be that obscuration is the cause of the colors. If Schasler thinks that the laws of harmonious colors can be thus explained he is certainly mistaken ; it is just

the physical explanation of color, so energetically opposed by Schasler, which conforms with the greatest accuracy to the laws governing the æsthetic combination of colors and the physiology of the nerves. The principal sentence with which he attempts to overthow the present theories, is as follows: "The only two objective factors, the product of which is called 'color,' are light and obscuration; *i. e.*, the misty atmosphere of the earth, which modifies the light in various ways and transmits these modifications to the eye, which is organized to perceive them."

SHUFELDT (88) reports as follows: A man of 21 (white-washer), perfectly healthy, who never had received any injury. Right eye emmetropic; left, myopic. With both eyes open he sorts correctly the similar shades of purple and green according to Holmgren's method, but hesitates slightly in picking out the red. With the left eye only open he lays together red, brown, and yellow in shades varying from dark to light ochre-yellow. Green and purple shades are selected correctly with this eye. BURNETT.

B.—ANOMALIES OF REFRACTION AND ACCOMMODATION, LIDS, LACHRYMAL APPARATUS, MUSCLES AND NERVES, ORBIT AND NEIGHBORING CAVITIES, CONJUNCTIVA, CORNEA, SCLERA, AND ANTERIOR CHAMBER.

By Dr. C. HORSTMANN.

I.—ANOMALIES OF REFRACTION AND ACCOMMODATION.

89. BAAS. The increase of myopia. *Med. chir. Centralbl.*, 1883, No 3.

90. CHASANOW, S. The progression of myopia. Inaug. Dissert., Königsberg, 1883.

91. MANZ. The eyes of the school-children of Freiburg. Freiburg and Tübingen, 1883, J. C. B. Mohr.

92. DÜRR. The refraction of 414 scholars after instillation of homatropine. *Graefe's Arch. f. Ophth.*, vol. xxix, 1, p. 103.

93. HANSEN, W. Examination of the eyes of 808 school-children between the ages of 10 and 15. *Klin. Monatsbl. f. Augenheilk.*, vol. xxxi, p. 196.

94. DOBROWOLSKY, M. Vision and myopia of the scholars of the Ural high-school. *Wratsch*, 1883, No. 6.

95. SCHADOW. The eyes of the school-children of Borkum. *Klin. Monatsbl. f. Augenheilk.*, vol xxxi, p. 150.

96. MITTENDORF, W. J. The influence of civilization on the human eye, especially on the development of myopia. *Verhandl. d. deutschen ges.-wissenschaftl. Ver. in N. Y.*, vol. v, pp. 30–38.

97. PAULSEN. The development and treatment of myopia. Berlin, 1883, A. Hirschwald.

98. HUNT, D. The cause of myopia. *N. Y. Med. Journ.*, 1883, No. 10.

99. MILLINGAN, E. VAN. The ophthalmic hospital at Constantinople. Report for 1880 and 1881.

100. KÖNIGSHÖFER. The mechanism of hand-writing. *Berlin. klin. Wochenschr.*, 1883, No. 11.

101. BERLIN, R. and REMBOLD. Investigations on the influence of writing on the eyes and attitude of school-children. Stuttgart, 1883.

102. BONO. Indice cefalico e refrazione oculare. *Giorn. de R. accad. di med. di Torino*, 1883, No. 1.

103. NORDENSON, E. Récherches ophthalmométriques sur l' astigmatisme de la cornée chez les écoliers de 7 à 20 ans. *Annal. d' ocul.*, 1883, vol. lxxxix, p. 110.

104. GIRARD. Astigmatisme mixte de l' œil droit, mixte de l' œil gauche, longstemps méconnu, asthénopie, photopsie, et myodésopsie; interprétation et provisions cliniques. *Rev. trim. d' ophth.*, Jan. 5, 1883.

105. CULBERTSON. A method of determining ametropia with prisms. *Cincinn. Lancet and Clin.*, Jan. 20, 1883.

106. JAVAL. Déformations cristalienne et cornéenne dans l' accommodation. *Soc. de biol.*, 1883, 2 mens.

107. PEREYRA. Spasmo acuto di accommodazione per nevralgia del trigemino. *Boll. d' ocul.*, vol. v, 7, p. 191.

108. SIMI. Ottalmojatria. Lezione I, II, and III. *Boll d' ocul.*, vol. v, No. 7. Lectures on refraction and accommodation.

109. HANSELL, H. F. Ophthalmic memoranda. Refraction. *Med. Bull.*, vol. v, 4, p. 76.

110. BURCHARDT. International test-types. 3d ed. Kassel, 1883. Consists of points and dots.

BAAS (89) calls attention to the fact that the cause of myopia of

school-children must not be sought in the school alone, but also in the greatly increased length of time devoted to study at home. Unsuitable conditions at home, poor illumination, disproportionate seats, etc., also contribute their share. To prevent the development and increase of myopia, the time devoted to study at home must be diminished, so that the children may have a chance to play in the open air.

MANZ (91) publishes his investigations of the eyes of the school-children of Freiburg, and finds the well-known conditions. In addition to other preventive measures against myopia, he calls attention to the present method of writing; the present slanting system causes a bad attitude of the head, which may partly be prevented by a more perpendicular style. More importance should be attached to clearness than beauty of penmanship.

DÜRR (92) examined the eyes of the scholars of the lyceum and the seminary at Hanover, after previously instilling a five-per-cent. solution of homatropine. He found that in four fifths of all examined a portion of the accommodation was latent, being equal to 1–1.33 D in the great majority. Of 414 examined, 263 were hypermetropic, and 133 myopic, the rest emmetropic. In 94 of the 133 myopes there were no changes in the choroid; in the remaining 39 there was a conus in 14, and sclerectasia posterior in 25. The degree of myopia had increased in the older scholars. There was less myopia among the scholars of the seminary than of the lyceum. The author thinks that this is due to the shorter hours of work in the public schools, of which the former are the continuation, as compared with the lower classes of the high-schools. In younger years the eyes should not be strained severely, in order to preserve them in a more normal condition.

HANSEN (93) examined 808 school-children between the ages of ten and fifteen, 753 of whom were hypermetropic, and 23 myopic. The average degree of hypermetropia at the age of ten was 1.75 D, which decreased to 0.75 D at fourteen.

DOBROWOLSKY (94) calls attention to the fact that most of the scholars of the Ural high-school are children of inhabitants of the prairies, to which must be ascribed their acuteness of vision and the rarity of myopia, and not to favorable hygienic conditions of the schools. The injurious influence of the school manifests itself here also when the lowest and highest classes are compared. Among 212 scholars there were 136 Kossaks,

75 % of whom had V > 1, 21 % V = 1, 4 % V < 1; in 76 other inhabitants, V > 1 in 63 %, V = 1 in 30 %, and V < 1 in 17 %. In the lowest classes, V > 1 in 65 %, V = 1 in 29 %, and V < 1 in 16 %; in the highest classes, V > 1 in 40 %, V = 1 in 40 %, and V < 1 in 20 %. There was 12 % of myopia: in the lower classes, 7 %; in the higher, 40 %. The degree of myopia in 73 % was equal to or less than $\frac{1}{12}$, greater in 27 %. HIRSCHMANN.

SCHADOW (95) examined the eyes of the school-children of Borkum. He found only one myopic child in 146; of the remainder $\frac{1}{3}$–$\frac{1}{4}$ were emmetropic, the others slightly, a few more highly hypermetropic. V = $\frac{1}{3}$ in 92 %, and was diminished in only 3 %; in the others it was normal.

MITTENDORF (96) explains the views now current in regard to the development of myopia in the schools. He examined the eyes of 2,030 children in the schools of New York, in conjunction with Dr. R. H. Derby, not only with glasses, but also with the ophthalmoscope. He also observed the increase of myopia in the higher classes. BURNETT.

PAULSEN (97) discusses the various theories of the development of myopia, explains at length his own of distention, and gives advice in regard to the treatment.

HUNT (98) attempts to combat the prevalent views in regard to the hereditary disposition to myopia, and looks at the subject from an embryological point of view. The best idea of the author's meaning can be obtained by referring to his own words, when he says: "It seems natural to assume that the cerebral tissue will impress its form during its growth upon the tissue in which it is contained. This tissue assumes its permanent shape later in form of the bony skull. The cerebral substance constituting the eye also impresses its shape upon the tissue forming the sclera, and it seems natural to conclude that this phenomenon of mutability of the human eye is a collateral one, instead of being a change due to function and heredity, and that the brain is the organ to which the eye is closely related." BURNETT.

KÖNIGSHÖFER (100) proves that the laws governing the movements of the eyes do not come into action at all, or only slightly so, in writing. The conclusions of Berlin (see *antea*) are, therefore, erroneous. The direction of the writing is entirely immaterial, as far as the laws governing the movements of the eye are concerned. The sole cause of the various bad attitudes of the

body is the attempt to find the most comfortable position of the wrist and fingers.

Bono (102) has determined the cranial index (of course, only the ratio between length and breadth), according to Broca's method, in 250 persons, 78 of whom were myopic, 100 emmetropic, and 72 hypermetropic, and compared it with the refraction. The interesting fact was revealed that the index of the myopes was 80, of the emmetropes 81, and of the hypermetropes 87. In eight pairs of brothers, one of whom was myopic, the other hypermetropic, the index of the former was 74–81 ; of the latter, 84–88; the mean difference was therefore 8. The author thinks he may conclude from his measurements that the depth of the orbit corresponds to the dolicho- or brachy-cephalous configuration of the skull, and that this determines the dimensions or refraction of the globe respectively. Dantone.

Nordenson (103) examined the eyes of 226 scholars of the École Alsacienne of Paris, with the ophthalmometer of Javal-Schjötz, and reports his results in detail. He concludes from his investigations that the lens generally corrects the corneal astigmatism, acting as a convex-cylindrical glass, whose curvature in its various axes varies in consequence of unequal contraction of the ciliary muscle. In this manner, Nordenson explains the fact that young emmetropes, with a corneal astigmatism of 1.5 D, had $V = 1$, without correcting it ; the corresponding glass even diminished their vision. $V > 1$ does not exclude astigmatism, but in cases of asthenopia astigmatism must be sought for as one of the most probable causes. Marckwort.

Culbertson (105) determines the degree of ametropia by doubling the image of an object by means of a double prism with the bases together. When an object of definite size is at a certain distance, the images touch at the edges. A departure from this indicates ametropia. Its degree is determined by the glass which when placed before the prism would produce the same image. The method is available for determining the degree of myopia, hypermetropia, and astigmatism. Burnett.

Pereyra (107) observed a visual disturbance in an hysterical lady during an attack of tic douloureux, which proved to be a spasm of accommodation (apparent myopia $= \frac{1}{14}$). After instilling atropine the true refraction was found to be $H = \frac{1}{14}$.

Dantone.

II.—LIDS AND SURROUNDINGS.

111. STORY, J. B. Operations for trichiasis and entropium. *Ophth. Rev.*, Feb. 1883, vol. ii, 16, p. 37.

112. EVERSBUSCH. The operation of congenital blepharoptosis. *Klin. Monatsbl. f. Augenheilk.*, 1883, vol. xxi, p. 100.

113. BOUVIN, M. J. Plastische operaties der vogleden met ongestelde huitlappen. *Weekblad.*, No. 13, 1883.

114. SCELLINGO. Nota clinica intorno alla cura dell' entropion. *Boll. d' ocul.*, vol. v, 7, p. 195.

115. VERON, L. Cautérisation palpébrale chez les granuleux. *Arch. d' ophth.*, vol. iii, 3.

116. FIEUZAL. Ectropion cicatriciel; autoplastie. *Soc de chir.*, July 12, 1883.

117. RICHET. Tumeur érectile de la paupière chez un petit enfant. *Rec. d' ophth.*, vol. iii, 1, p. 12.

118. EPÉRON. Sarcome de la région interne de la paupière gauche; exstirpation; autoplastie. *Arch. d' ophth.*, vol. iii, No. 3.

119. THOMSON. Abscess of eyelid of eleven months' standing simulating tumor of orbit. *Med. Times and Gaz.*, No. 1711.

120. MAKROCKI, F. Case of perversely grown subcutaneous lashes. *Centrabl. f. prakt. Augenheilk.*, 1883, p. 129.

STORY (111) reviews the various operations for entropium in trichiasis and recommends the method of Spencer Watson. He forms at each end of the lid both a ciliary and a cover flap. The base of the former is at the middle of the base of the upper lid, of the latter at both ends. He transplants one flap from above, in order to fill the space left by the elevation of the ciliary flap. If sutures according to Anagnostakis are applied besides, in order to fasten the ciliary flap to the tarsus, the lid cannot be turned inward again. In order to prevent the flap from touching the cornea, Dianoux recommends to leave the ciliary flap in connection with the lid at both ends, and to pass the other flap through the button-hole left between it and the tarsus.

In operating for congenital blepharotosis EVERSBUSCH (112) applies Snellen's blepharostat in such a manner as to push the plate high up behind the lid. When the screw is turned down, not only the tarsal portion of the upper lid but also its continuation to the fornix and skin of the forehead must be within the instrument. He then cuts through the skin and the orbicularis

muscle in almost the whole breadth of the lid, parallel to its edge and at an equal distance from it and the eyebrow. He then detaches the skin and muscle upward and downward to the extent of 4 *mm.*, so as to expose the upper fornix and the insertion of the levator at the tarsus. A suture is then applied at the exposed insertion of the levator, and the needle passed downward between the orbicularis and the tarsus, so as to reappear in the middle of the edge of the lid. Before tying the threads at the edge of the lid, he unites the wound. The tendon of the levator is thus brought forward and the ptosis diminished.

Bouvin (113) has successfully transplanted a flap without a pedicle in cases of entropium, and believes that this method combined with a moist bandage with lukewarm boracic acid deserves more attention than it has hitherto received.

Scellingo (114) claims to have obtained good results in entropium by forming a scar at the margin of the lid with the thermo-cautery of Pacquelin. Dantone.

Veron (115) recommends the thermo-cautery in entropium and trichiasis, with which he makes an incision to the tarsus parallel to the edge of the lid, at a distance of 1 *cm.* from it. The effect upon the granulations, pannus, and ulcerations is favorable, while the disease itself is also cured. Several cases are reported.

v. Mittelstädt.

Fieuzal (116) presented a man who was operated when a child for cicatricial ectropium; the flap was taken from the forearm. Marckwort.

Richet (117) reports a case of erectile tumor of the lid, which he intended to treat with injections of sesquichloride of iron. The concentration of the solution shall be determined by experiments upon the coagulation of the patient's blood with solutions of varying strength. Marckwort.

Epéron (118) reports a case of sarcoma observed and operated in Landolt's clinic, which had developed in a woman of thirty-two in the course of six months, and occupied the region of the left lachrymal sac, the bridge of the nose, and the neighboring part of the cheek. It was extirpated, and the large defect covered with a sliding flap. Rapid recovery; no relapse. Cosmetic effect very good. The microscope showed that the tumor had developed in the connective tissue of the muscles; these were partly destroyed by the tumor, which was found to consist of

small round cells with large nuclei. The hyaloid degeneration of the sheaths of the blood-vessels here and there seems to confirm Billroth's theory of the development of cylindromata.

V. MITTELSTÄDT.

MAKROCKI (120) saw several little nodules on the upper lid of both eyes of a lady. After incising the skin over them, several well-formed lashes were easily extracted. A few days later only a fine scar remained in place of the nodule.

III.—LACHRYMAL APPARATUS.

121. DEHENNE. Tumeur lachrymale congénitale. *Soc. franç. d' ophth.*, 1883.

122. DESPRÉS. Rapport sur une observation de M. Parinaud: Fistule lacrymale d' origine dentaire. *France méd.*, Feb., 1883.

123. MAYET. Du traitement doux et rapide du larmoiement et de la dacryocystite. *Thèse de Paris*, 1883.

124. FIVRE, CESARE. Dilatatore delle vie lagrimali. *Ann. d' ottalm.*, vol. xii, 1, p. 6.

125. THOMSON. Treatment for suppuration of tear-passage. *Med. Times and Gaz.*, No. 1711.

DEHENNE (121) reports a case of congenital tumor of the lachrymal sac; he opened it like an abscess. TERSON observed two similar cases; PARINAUD one in the child of syphilitic parents. COURSERANT saw a similar affection in both eyes of a patient. GALEZOWSKI has treated several such cases with simple injections of water with good results. MARCKWORT.

PARINAUD (122) observed a fistula of the lachrymal sac, which he thinks was due to an affection of the root of the canine tooth. MARCKWORT.

IV.—MUSCLES AND NERVES.

126. GUTTMANN, G. A case of advancement of the inferior rectus muscle, whose insertion had been moved back by an injury. *Centralbl. f. prakt. Augenheilk.*, 1883, p. 36.

127. BURCHARDT. Annual report and observations on the effect of the squint-operation on the vision of the squinting eye. *Berliner Charité Ann.*, vol. viii, p. 592.

128. Mortais. De l' emploi des louchettes consécutivement à l' opération du strabisme convergent. *Soc. franç. d' ophth.*, 1883.

Guttmann (126) describes the case of a woman of forty-two, in whom an injury had produced strabismus sursum vergens paralyticus and a partial anterior symblepharon of the lower lid. The symblepharon was divided, and the inferior rectus advanced. The strabismus disappeared entirely, and only a slight dynamic divergence remained.

Mortais (128) prescribes strabismus spectacles immediately after the operation. According to the degree of divergence desired, the vertical slit must be placed either in the middle of the plate covering the squinting eye, or more to the temporal side. The good eye is kept completely closed.

129. Berger. Paralyse de l' acoustique et du trijumeau. *Rec. d' ophth.*, vol. iii, 1, p. 25.

130. Hughlings-Jackson. Movements of the eyes in ear-disease. *The Lancet*, 1883, No. 3.

131. Lees. Paralysis of the third nerve, with cerebral symptoms. *The Lancet*, 1883, No. 3.

132. Lees. Paralysis of the sixth nerve, with choreiform movements of the face. *The Lancet*, 1883, No. 3.

133. Benson. Paralysis of the ocular muscles after diphtheria. *The Lancet*, 1883, No. 11.

134. v. Hasner. A case of periodic paralysis of the oculomotor nerve. *Wiener med. Wochenschr.*, No. 12; *Prager med. Wochenschr.*, No. 10.

135. Parinaud. Paralyse des mouvements associés des yeux. *Arch. de neurol.*, 1883, No. 14.

136. De Vincentiis. Contribuzione alle localizzazioni cerebrali. *Revista clinica*, 1883.

137. Thomson. Spasm of the eyelids and ciliary muscles, with intense pain caused by exposure to electric light. *Med. Times and Gaz.*, No. 1711.

Berger (129) describes two cases of paralysis of the acoustic and fifth nerves with paresis of the facial nerve, due to caries of the petrous portion of the temporal bone; in one of the patients, the cornea of the affected side had remained intact, though without sensibility; in the other, there was neuroparalytic keratitis.

Marckwort.

BENSON (133) observed in a girl of eleven, who had suffered from diphtheria, besides other paralyses, an affection of the ciliary body in the fifth week, which continued for seven weeks; in the ninth week the levator palpebrarum was paralyzed, and remained so for a week; at the same time the abducens muscles were paralyzed, which condition continued for three weeks. In the tenth week there were convergence and diplopia for four days. Paralysis of the ciliary muscle is the most common symptom. The lesion must be sought at the centre of accommodation, at the posterior portion of the floor of the third ventricle.

HASNER (134) observed a paralysis of the left oculomotor nerve in a girl of seventeen, which always occurred, for the last four years, as soon as menstruation began, and lasted for three days. Hyperæmia, due to menstruation, at the origin of the left oculomotor nerve, was probably the cause, producing transient paralysis by pressure.

DE VINCENTIIS (136) observed total paralysis of the right external rectus and left internal rectus muscles (conjugate paralytic strabismus), in a tuberculous girl of thirteen, five months before her death. V normal in both eyes; no diplopia, though the head was constantly kept turned to the right; there were no other paralyses. The autopsy confirmed the diagnosis of tuberculous infiltration of the origin of the abducens, as a caseous tumor, the size of a pea, was found on the floor of the fourth ventricle in the right corpus candicans. No lesion of the cerebral substance was noticed in the aquæductus Sylvii, where the nuclei of the third pair are found. A histological examination of the paralyzed nerves, unfortunately, could not be made. DANTONE.

THOMSON (137) observed painful blepharospasm, and spasm of the ciliary muscle, after exposure to the electric arc-light.

138. MOUCHET. Nevralgie du trijumeau, tic douloureux. Elongation du nerf dentaire inférieur droit. *Soc. de chir.*, Feb., 1883.

139. NIÇAISE. De la resection du nerf sous-orbitaire dans le tic douloureux ou nevralgie faciale rebelle. *Paris méd.*, Dec., 1882.

140. PÉAN. Traitement chirurgical des nevralgies: section, résection, cautérisation, élongation, arrachements des nerfs. *Gaz. des hôp.*, Jan., 1883.

MOUCHET (138) stretches the dental nerve for neuralgia of the fifth nerve, it being most severe in the region of that branch. The affection was cured, but a slight difficulty in chewing was experienced afterward. MARCKWORT.

In treating tic douloureux, NIÇAISE (139) institutes a close search for its cause (syphilis, anæmia, carious tooth, etc.), and then tries to remove it. If this treatment fails, division, stretching, or resection of the nerve must be resorted to. In one case, Niçaise performed a very extensive resection of the infra-orbital nerve, after he had opened the upper wall of the bony canal. MARCKWORT.

In obstinate cases of facial neuralgia, PÉAN (140) destroys the nerve in question to a great extent; he tries to tear out as large a piece of the nerve as possible, and then passes a glowing platinum wire into the bony canal. The supra-orbital nerve, however, should be very carefully stretched. MARCKWORT.

V.—ORBIT AND NEIGHBORING CAVITIES.

141. NOTTA, MAURICE. Abscès du sinus frontal; guérison. *Rec. d' ophth.*, vol. iv, No. 3, p. 161.

142. PEARSON. Necrosis of roof of orbit. *The Lancet*, 1883, No. 11.

143. THOMSON. Gunshot accident, causing fracture of bone and chorio-retinitis. Bullet lodged in orbit. *Med. Times and Gaz.*, No. 1711.

144. DE LA PEÑA. Echinococcus orbitæ. *Rec. d' ophth.*, vol. iv, No. 2.

145. BARABASCHEW, N. A second case of echinococcus of the orbit. *Wratsch*, 1883, No. 1.

146. PANAS. De l' inflammation de la bourse celluleuse retro-oculaire ou ténonite. *Arch. f. ophth.*, vol. iii, No. 3.

147. PANAS. À propos de deux nouvelles observations d' angiomes caverneux de l' orbite. *Arch. d' ophth.*, vol. iii, No. 1, p. 1.

148. GAYET. Tumeur pulsatile de l' orbite suivie de guérison. *Ann. d' ocul.*, 1883, vol. lxxxix, p. 35.

149. GUSSENBAUER. Extirpation of a cavernous angioma of the orbit with preservation of the globe. *Wiener med. Wochenschr.*, 1883, No. 9.

150. FROST, W. A. Pulsating exophthalmus. *Ophth. Soc. of the Unit. Kingd.*, March 3, 1883. *The Lancet*, No. 11.

151. EALES. Exophthalmus and optic neuritis. *The Lancet*, 1883, No. 11.

152. PEPPER. A clinical lecture on exophthalmic goitre. *N. Y. Med. Journ.*, 1883, No. 6.

153. FITZGERALD, W. A. The theory of a central lesion in exophthalmic goitre. *Dublin Journ. of Med. Sci.*, March 1883, p. 201.

154. BALLET. De quelques troubles dépendant du système nerveux central observés chez les malades atteints de goître exophthalmique. *Rev. de méd.*, 1883, No. 4.

NOTTA (141) reports a case of abscess of the frontal sinus, which had developed into a tumor the size of a pigeon-egg at the inner portion of the margin of the left orbit, after a part of the lower wall of the sinus had been absorbed; it disappeared on pressure, while offensive greenish pus was discharged from the left nostril. The abscess was opened, the inner wall of the frontal sinus scraped, drainage-tubes inserted for two days, and the cavity syringed out with carbolic acid; and in three weeks it was cured (*cfr. König. spec. Chir.*, vol. i, p. 232).

MARCKWORT.

PEARSON (142) reports the case of a young girl of ten, who was suffering from a stiff neck. Soon after the right upper lid began to swell, but improved again. Later a relapse with delirium set in, resulting in death on the 10th day. The autopsy showed that the right orbital plate was inflamed and discolored and partly destroyed; the dura mater above the petrous portion of the right temporal bone was covered with a yellow exudation, while the right temporal lobe of the brain, the right optic nerve, and the surrounding tissue were infiltrated.

DE LA PEÑA (144) found an echinococcus behind a highly diseased and blind eye which he had enucleated. Once before, he had observed a very similar case. According to him the echinococcus in the orbit passes through three stages of development, presenting the following symptoms: (1) Slight exophthalmus, with Vn and Tn, slight and transient pain; (2) increased exophthalmus, decrease of V, high T; (3) marked exophthalmus, dislocation of the globe outward, complete loss of V, suppuration of the cornea.

MARCKWORT.

P. BARABASCHEW (145) reports the following case: patient twenty-seven years old, formerly soldier, marked exophthalmus of the right eye, chemosis, partial xerosis of the cornea, V = o, choked disc; the orbit filled with a smooth, tense tumor, distinctly fluctuating, and dislocating the globe downward and outward. In 1877, while he was a soldier, a shell exploded near him and he became unconscious. After half an hour he recovered, when he noticed that vision in the right eye was greatly impaired. Two months later the eye gradually began to swell. Diagnosis by exclusion: echinococcus of the orbit. When punctured 7½ 3 of colorless liquid were discharged (traces of albumen, much NaCl, doubtful reaction for succinic acid, no phosphates). After the puncture severe reaction, œdema extending to the temple and lasting several days. Operated by making an incision at the upper inner edge of the orbit, preserving the globe. Fifteen larger and smaller echinococci were removed, varying in size to that of a pigeon-egg, and finally the original cyst. After the operation severe reaction and slow recovery (as also in another case described a short time ago by the same author).

HIRSCHMANN.

PANAS (146) discusses the symptoms, course, and treatment of inflammation of Tenon's capsule and reports three cases in which it had developed after a cold in persons suffering from arthritis, and had been successfully treated with salicylate of soda, warm applications, compressive bandage, and scarification of the chemotic folds of the conjunctiva. Three principal symptoms were observed in every case: pain, serous chemosis, and difficulty in moving the eye. In one case, swelling and pulsation of the retinal veins, which afterward disappeared. Pupil normal.

v. MITTELSTÄDT.

PANAS (147) removed a cavernous angioma of the right orbit in a woman of twenty-three. Exophthalmus began to develop when she was eleven years old, after a simple angioma at the angle of the lids had apparently been cauterized several times. The eye afterward became inflamed and then atrophic. When the tumor was removed it was necessary to detach the muscles from it, but not a trace of the atrophic globe could be found. The tumor, which was thought to be a cavernous fibroma, was 6 *cm.* long, 4-5 *cm.* thick, and resembled a potato. Poncet thought that the pigment found in considerable quantities in the intercavernous connective tissue was derived from the choroid, but proved to be metamor-

phosed blood. Three months later symptoms of sympathetic ophthalmia were observed in the left eye, which disappeared when a small tumor, sensitive to pressure and situated at the inner lower side of the orbit, was removed, which proved to be the totally atrophic globe. A second case was that of a boy ten years old, from whose left orbit a cavernoma had been removed with the eye by some other surgeon. A small angioma of the eyebrow had escaped observation at the time and was removed by Panas, after it had grown considerably. v. MITTELSTÄDT.

GAYET (148) describes a case of pulsating orbital tumor, the precise diagnosis of which he leaves in doubt. The auscultation of the tumor underwent interesting changes. Eight days after the injury which was supposed to be the cause, an intermittent blowing noise was heard behind the eye, and soon afterward the same noise increased during the systole; it was so loud that it could be heard when the whole head and neck down to the fifth cervical vertebra was auscultated. Suddenly marked protrusion of the globe developed, pulsation ceased, and the blowing noise decreased. This condition was succeeded by another very different one: continuous blowing sound, increased during systole, noises, and pulsation. One day all the symptoms disappeared and the eye recovered completely. MARCKWORT.

GUSSENBAUER (149) removed a cavernous tumor of the left orbit in a woman of thirty-three, preserving the globe. It was due to an injury and had caused exophthalmus. The eye again moved freely, and vision improved which had been impaired by neuritis.

FROST (150) observed a case of double pulsating exophthalmus, which had developed in a man of thirty-eight, after an injury received eighteen years ago. Probably the middle cerebral fossa had been fractured. The left carotid was probably injured and communication had been established between it and the sinus. Dilatation of the orbital veins resulted, which condition was transmitted to the veins of the other side through the transverse sinus.

VI.—CONJUNCTIVA, CORNEA, SCLERA, ANTERIOR CHAMBER.

155. GALEZOWSKI-DAGUENET. Maladie de la conjonctive. Diagnostic et traitement des affections oculaires. Paris, 1883.

156. PFLÜGER. The ophthalmic clinic of Berne University. Report for 1881. Berne, 1883, p. 16.

157. Simpson, R. A. The prophylaxis of ophthalmia neonatorum. *Edinburgh Med. Journ.*, vol. cccxxxiv, April, 1883. *Arch. f. Gynäk.*, vol. xxi, 2.

158. Credé, C. The prevention of ophthalmia neonatorum.

159. Landesberg. Iodoform in ophthalmology. *Centrabl. f. prakt. Augenheilk.*, 1883, p. 6 ; *Med. Bull.*, vol. v, 3, p. 57.

160. Keyser, P. D. Iodoform in gonorrhœal ophthalmia. *College and Clinical Rec.*, vol. iii, No. 12, Dec. 18, 1882.

161. Fialkowsky, J. A few words on iodoform in ophthalmology. *Medicinsky Westnik.*, Nos. 8 and 9.

162. Richez, P. L' iodoform dans la blennorrhœa oculaire. *Thèse de Lille*, Nov., 1882.

163. Hartridge. Boroglyceride in the treatment of purulent ophthalmia. *The Lancet*, No. 3.

164. Pechin, A. Traitement de la conjonctivite purulente grave. *Thèse de Paris*, 1883.

165. Lewin. Boracic acid and its application in modern medicine. Inaug. diss., Bonn, 1883.

166. Dartigolles et Armaignac. Observation de conjonctivite pseudo-membraneuse chez un enfant de huit mois. *Rev. clin. d'ocul.*, vol. iv, Nos. 3 and 4.

167. Perrin. Ophthalmie purulente. *Progr. méd.*, vol. xi, No. 19.

168. Unterharnscheidt, V. The treatment of trachoma. *Klin. Monatsbl. f. Augenhéilk.*, vol. xxi, p. 53.

169. Just. The galvano-caustic treatment of trachoma. *Klin. Monatsbl. f. Augenheilk.*, vol, xxi, p. 162.

170. Ferrier. Inoculation purulente dans le traitement des granulations de la conjonctive et de la cornée. *Rev. de chir.*, vol. iii, No. 2.

171. Baudry. Fragments d' ophthalmologie pratique. Paris, 1883, Bertier.

172. Parizot. Des formes attenués de l' ophthalmie blennorrhagique. *Lyon méd.*, 1882.

173. De Wecker, L. Jequirity ophthalmia. *Klin. Monatsbl. f. Augenheilk.*, vol xxi, p. 1.

174. De Wecker and Moura-Brazil. On the use of jequirity in eye-diseases. *London Med. Rec.*, 1883, No. 94.

175. De Wecker. Quelques indications sur l' emploi du jequirity. *Ann. d' ocul.*, vol. lxxxix, p. 100.

176. Warlomont. Jequirity. *Ann. d' ocul.*, vol. lxxxix, p. 97.

177. Deneffe. L' ophthalmie granuleuse et le jequirity. *Ann. d'ocul.*, vol. lxxxix, p. 104.

178. Gruening. Jequirity in the treatment of inveterate pannus. *Med. Rec.*, Mar. 17, 1883.

179. Mazza. Jequirity. *Ann. di ottalm.*, vol. xi, p. 506.

180. Paggi. Jequirity. *Boll. d' ocul.*, vol. v, p. 203.

181. Moyne. Jequirity. *Boll. d' ocul.*, vol. v, p. 6.

182. Ponti. Jequirity. Lettera contributo al Dr. Moyne. *Boll. d' ocul.*, vol v, p. 7.

183. Simi. Jequirity. *Boll. d' ocul.*, vol. v, p. 5.

184. Zwingmann, L. Diffuse diphtheritic conjunctivitis of both eyes causing death by acute swelling of the cervical lymphatic glands in a child five months old suffering from eczema of the face. *St. Petersb. med. Wochenschr.*, 1883, No. 5.

185. Loring. Case of osteoma of the conjunctiva. *N. Y. Med. Jour.*, Jan., 1883.

186. Vassaux, M. G. Sur quatre cas de dermoide de l' œil. *Arch. d' ophth.*, vol. iii, 1, p. 16, 1883.

187. Falchi, E. Granuloma e tuberculosi della conjunctiva. *Ann. d' ottalm.*, vol. xii, 1, p. 36.

188. Hesseling. On tuberculosis of the conjunctiva. Inaug. Diss., Bonn, 1883.

189. Kuschbert and Neisser. The pathology and etiology of epithelial xerosis of the conjunctiva and idiopathic hemeralopia. *Breslauer ärztl. Zeitschr.*, 1883, No. 4.

190. Chiari, H. Congenital ankyloblepharon and symblepharon and congenital atresia laryngis in a child with several other anomalies of formation. *Zeitschr. f. Heilk.*, vol. iv., p. 143.

191. Noyes. Transplantation of conjunctiva from the rabbit. Alloplasty. *N. Y. Med. Rec.*, March 3, 1883.

Galezowski and Daguenet (155) subdivide conjunctivitis into catarrhal, purulent, diphtheritic, granular, and phlyctenular conjunctivitis. In treating acute catarrhal conjunctivitis, cold applications should be avoided, though they are sometimes moment-

arily pleasant; on the contrary, the eyes should be bathed several times a day with hot water. Besides the ordinary methods of treatment, they recommend the application of six leeches to the temple and instillation of atropine. The sensation of a foreign body sometimes felt is frequently due to delicate, half-detached shreds of conjunctiva, and can best be allayed by applying vaseline. In the beginning of purulent conjunctivitis, and while the conjunctiva is but slightly injected, the caruncle and semilunar fold are most inflamed, being most exposed to infection. Purulent conjunctivitis must not be treated with lapis infernalis, but with the mitigated stick. This must be applied as soon as possible, and twice daily, both in adults and children, less often (every 2–3 days) when the discharge decreases. Complicating corneal affections are not due to the cauterizations and cold applications, as they remove the causes of affections of the cornea. Antiseptics are also useful in treating purulent conjunctivitis, as the eye is sprayed 4–5 times daily with a 1 % solution of carbolic acid for 4–5 minutes. In blennorrhœa neonatorum they do not use the mitigated stick, but a 2½ % solution of nitrate of silver twice daily.

"Ophthalmie purulente des enfants scrofuleux ou ophthalmie croupale." This disease is peculiar to early childhood (2–6 years), and nothing else than catarrhal conjunctivitis or phlyctenular kerato-conjunctivitis, which in scrofulous children and under poor hygienic conditions gradually develops the symptoms of a genuine purulent, croupous conjunctivitis. The best remedies are iodoform or oleum cadini in form of a salve. In xerosis of the conjunctiva transplantation should be tried, although the chances are slight when the disease has reached an advanced stage. MARCKWORT.

PFLÜGER (156) believes that every disinfectant, which though only temporarily irritates the conjunctiva, causing increased discharge, creates more favorable conditions for the development of secondary affections. For this reason he is opposed to Credé's method for the prevention of blennorrhœa neonatorum, the instillation of a 2 % solution of nitrate of silver.

CREDÉ (158) believes that only the specific virus of gonorrhœa can produce the blennorrhœa of the new-born. The catarrhal secretion of the genital organs, so frequently met with, cannot produce a specific infection of the eyes, but only a catarrh. Protraction of the final stage of delivery, premature rupture of

the sac, finally the birth of large children, favor infection. In order to prevent the development of the disease, Credé instilled a 2 % solution of nitrate of silver into the eyes of every child, and then applied rags dipped in a solution of salicylic acid, in order to diminish any swelling or redness which might set in. Later, this part of the treatment was discontinued. The percentage of blennorrhœa was thus reduced from 10 % to 0.2 %.

LANDESBERG (159) believes iodoform to be absolutely injurious in blennorrhoic and catarrhal conjunctivitis, and useless in granular conjunctivitis and dacryocysto-blennorrhœa.

According to FIALKOWSKY (161) iodoform is injurious and absolutely contra-indicated in blennorrhœa ; useless in all conjunctival affections, but efficient in the various diseases of the cornea (in serpent ulcer), lids, and operations on the latter. In order to pulverize it more thoroughly, when intended for use as a salve, Fialkowsky advises to add a few drops of ether.

HIRSCHMANN.

RICHEZ (162) discusses the various forms of purulent and blennorrhoic conjunctivitis, and recommends iodoform-salve in treating the latter. MARCKWORT.

In protracted cases of trachoma, UNTERHARNSCHEIDT (168) removes the granules with the galvano-cautery. Solutions of nitrate of silver may be used between the cauterizations.

JUST (169) objects to this method.

BAUDRY (171) discusses blepharitis, conjunctivitis, and pannus, and the treatment of the last-named affection with jequirity.

MARCKWORT.

PARIZOT (172) recommends inoculation against pannus, and bases his claims on five cases which he cites. The pus should, however, be taken at the chronic stage of blennorrhœa, as the affection produced is then less severe. MARCKWORT.

WECKER (173, 174, 175) has made a series of experiments with the infusion of jequirity recommended by him for producing purulent ophthalmia to cure trachoma, and has arrived at the following results : Undoubtedly the infusion produces a purulent inflammation of a croupous character, the intensity of which can be regulated by the number of applications. The granulations rapidly disappear, and even if it should be necessary to produce this inflammation several times, the treatment is less disagreeable and dangerous than inoculation. The cornea is not endangered.

H.

After some general remarks on jequirity, and the controversy between de Wecker and Moura-Brazil as to whom may be ascribed the priority of its introduction, WARLOMONT (176) publishes a letter addressed to him by de Wecker, on "Quelques indications sur l' emploi du jequirity." It is indicated in the torpid form of granular conjunctivitis-trachoma. He then publishes a stenographic report of the meeting of the Académie de Médecine de Belgique, on March 31st, in opposition to De Wecker's conclusions.

DENEFFE (177) reported at this meeting on his experiments with jequirity, and comes to the conclusion "the inflammation produced by it fails to accomplish any therapeutical results." Warlomont does not declare himself either in favor of Wecker's or Deneffe's view. MARCKWORT.

GRÜNING (178) reports two cases in which he used jequirity with excellent results. One was a girl of nineteen; the other, a man of fifty-three. The infusion was applied three times daily, to the conjunctiva, with a fine camel's-hair brush, while compresses saturated with it were applied to the lids day and night. The first change in the conjunctiva was observed twenty-four hours after the first application. After the fifth day its use was discontinued. After two weeks the patients were discharged.

BURNETT.

MAZZA (179) applied jequirity in thirty cases of trachoma. Excellent results were obtained in five severe cases, in which the disease had lasted four years, and there was extensive pannus; the corneæ became perfectly clear. In five other cases improvement was not so marked, while in fifteen others no changes whatever took place; in the remaining five cases the result was absolutely negative, no inflammation whatever developing. He never saw it make a case worse. DANTONE.

PAGGI (180) succeeded with jequirity in one case of trachoma, but failed in a second. DANTONE.

PONTI (182) also applied jequirity in four severe cases of trachoma and pannus. The results were excellent, especially as regards the clearing of the corneæ. Besides the usual symptoms he observed in two cases considerable salivation, and in one profuse perspiration and nausea at the height of the inflammation.

DANTONE.

SIMI (183) obtained an excellent result with jequirity in a case

of mixed trachoma. The disease had lasted two years and had not yielded to various methods of treatment by several physicians. Total pannus of the right cornea, the left traversed by several blood-vessels. The applications and compresses were continued for eight days, until headache and slight fever set in. In the second week a 3-per-cent solution of nitrate of silver was applied on two successive days, whereupon the inflammation subsided and the trachoma and pannus disappeared. DANTONE.

LORING (185) observed an osteoma of the conjunctiva in a healthy and well-developed child of eight months. A narrow fold of skin was observed soon after birth at the upper outer angle, which in the course of five months assumed its present shape. No pain, no redness. The tumor was firmly united with the conjunctiva above and at the sides, but not with the globe. The tumor was removed and weighed. It weighed 25 milligrammes, was 8 *mm.* long, 5.5 *mm.* broad, and 2.5 *mm.* high. The longer diameter corresponded to the horizontal meridian of the eye. Dr. Welsh examined the tumor and found that it was surrounded by a thin fibrous capsule, and had a bony structure. BURNETT.

VASSAUX (186) describes four cases of dermoid tumors of the globe, three of them in boys between the ages of fourteen and fifteen, and the fourth in a young woman of twenty. In three the tumor was congenital, had grown latterly, probably through the stimulus of puberty, and had caused annoyance mainly by the growth of small hairs and lashes. The tumors were removed, recovery was rapid, and no relapses occurred. Microscopic appearance: typical structure of the skin, but no sudorific glands, which were found in only one case. The fourth case is remarkable for the fact that besides the congenital dermoid tumor the right half of the face was not symmetrical, and the mouth and ear were misshapen. This concurrence, observed also by others, seems to indicate the development of dermoid tumors during the embryonic period, which the author explains by an "invagination of the lids at some point upon the conjunctiva," which in turn would be due to a temporary union between the amnion and primary ocular vesicle at that spot. V. MITTELSTÄDT.

HESSELING (188) publishes another case of tuberculosis of the conjunctiva, after compiling the sixteen cases thus far described.

KUSCHBERT and NEISSER (189) observed an epidemic of

epithelial xerosis of the conjunctiva and idiopathic hemeralopia in the Breslau Orphan Asylum. Among eighty children twenty-five were affected, and without exception with both symptoms. The disease began in spring and disappeared in autumn. White foamy deposits of various sizes were found upon the conjunctiva within the limit of the palpebral fissure, and always either at the outer or inner corneal margin. They consisted of a fatty substance interspersed with a few epithelial cells, in which large masses of bacilli were embedded, well-marked by their shape and arrangement. The cornea was not affected.

Since 1878, Noyes (191) has transplanted pieces of conjunctiva of the rabbit in six cases; the cases, however, are not described in detail. He prefers black to white rabbits, the conjunctiva of the former being firmer. His method of operating differs from that of Wolfe, inasmuch as he does not transplant the conjunctiva directly upon the eye, but spreads it out upon a cork under water, so that he can manipulate it with greater ease. Burnett.

192. Galezowski-Daguenet. Maladies de la cornée. Diagnostic et traitement des affections oculaires. Paris, 1883.

193. Prouff, J. M. De la kératite en bandelette et son traitement. *Rev. clin. d' ocul.*, 1883, p. 181.

194. Magnus, H. On ribbon-shaped keratitis. *Klin. Monatsbl. f. Augenheilk.*, vol. xxi, p. 45.

195. Guaita. Des ulcères profonds de la cornée et leur traitement antiseptique. *Rec. d' ophth.*, vol. iii, 1, p. 44; 2, p. 90; 3, p. 160; 4, p. 224. *Ann. d' ottalm.*, vol. xi, p. 484.

196. Axel Holmer. Om ulcus cornæ serpens. Copenhagen, 1883.

197. Ludwig. The use of the actual cautery for serpent ulcer. Inaug. Diss., Erlangen, 1883.

198. Snell, S. The actual cautery in the treatment of corneal ulceration. *Brit. Med. Journ.*, Jan. 6, 1883.

199. Véron, L. Opération de Sæmisch (cautérisation palpebrale chez les granuleux). *Arch. d' ophth.*, vol. iii, No. 3.

200. Denarié. Sur un cas de kératite syphilitique. *Lyon med.*, Dec. 3, 1883.

201. Girard. Les grandes kératotomies. *Rev. trimestrielle d' ophth.*, Jan., 1883.

202. Carboné, E. De l' iridectomie dans la kératite parenchymateuse et dans la scléro-kératite. *Thèse de Paris*, 1882.

203. GALLENGA. Della doppia iridectomia nella cura dello stafiloma parziale della cornea. *Giorn. d. R. Acca. di med. di Torino*, 1883, No. 1.

204. LINK. Severe case of scrofula with a corneal abscess in both eyes. *Prager med. Wochenschr.*, No. 15.

205. KAHLER. On neuro-paralytic keratitis. *Prager med. Wochenschr.*, 1883, No. 8.

206. JAKUSIEL. Case of diffuse interstitial encephalitis with consecutive ulcerous keratitis in both eyes. *Berliner klin. Wochenschr.*, 1883, No. 7.

207. SCHINDELKA. Two cases of dermoid tumor of the cornea. *Œsterreich. Vierteljahrsschr. f. wissenschaftl. Veterinärkunde*, vol. lviii, No. 2.

In discussing the treatment of corneal affections GALEZOWSKI and DAGUENET (192) frequently recommend douches with Lourenço's atomizer instead of warm applications. When the symptoms of irritation are very pronounced leeches are applied, even in children. In ulcers of the cornea atropine and eserine are sometimes instilled alternately, eserine alone only when there is danger of a perforation. Herpes of the cornea is treated most effectively with methodical compression, or with a compressive bandage. Better results are obtained in serpent ulcer with keratotomy than with cauterization. In speaking of granular keratitis they recommend the excision of the upper fornix in obstinate forms of granular conjunctivitis. As soon as interstitial keratitis becomes complicated with iritis, iridectomy should be performed.

MARCKWORT.

In order to prevent relapses in ribbon-shaped keratitis PROUFF (193) has frequently excised a flap from the neighboring conjunctiva with good results. MARCKWORT.

MAGNUS (194) found a ribbon-shaped opacity in fourteen among seventy-five cases of persons more or less severely affected with ocular lesions; all the patients were still young. This opacity was not directly due to impaired nutrition followed by an affection of the whole eye, but it made the development of the opacity possible. Its actual development is due to the external influences to which the cornea is exposed. At first opacities, combined with a loss of corneal substance in the palpebral fissure, develop; later, calcareous deposits are formed. The band-shaped opacity of the cornea is a specific affection of eyes totally or

partially blind from constitutional diseases. For these reasons, therefore, it would seem advisable to substitute the name of "keratitis trophica" for band-shaped opacity of the cornea.

GUAITA (195) discusses corneal ulcers in a longer article, and especially their treatment. He treats them all strictly antiseptically. Boracic acid is added to the solutions of atropine and eserine, which are used in form of a salve, so that their action may last longer, though they are only used once a day (eserin. sulf. 0.07 or 0.1, acid. bor. 0.5, vasel. angl. 10.0). While the eye is being examined or the salve applied the eye is kept under a spray of boracic acid (6 %, temp. 40° C), and then bandaged with salicylated cotton.

Guaita has discarded the use of carbolic acid and thymol, as they irritate the eye too much; he recommends salicylic acid for bandaging, but it cannot be used in form of a spray, as it irritates the respiratory organs. Boracic acid may be used both for washing and bandaging. MARCKWORT.

AXEL HOLMER (196) closely defines the meaning of the term "corneal ulcer" as described by Saemisch. He considers the micro-organisms found in the secretion produced by dacryocysto-blennorrhœa the most common cause. He then discusses the former attempts at inoculation of rabbits' eyes with blennorrhoic secretion, and adds a few experiments made by himself. His results were almost always positive. He also inoculated eyes with blennorrhoic secretion which had been for five minutes in a two-per-cent solution of nitrate of silver, and always obtained negative results. At Dr. Edm. Hansen's clinic at Copenhagen the serpent ulcer is treated with a two-per-cent solution of nitrate of silver, a method which the author recommends, as it is supported by his experiments; in some cases the ulcer is first scraped out. If the affection is far advanced, he recommends the operation of Saemisch, and thinks that the actual cautery is only applicable to small ulcers. In regard to the development of hypopyon, he accepts the hypothesis of Horner. SCHJÖTZ.

SNELL (198) cauterizes corneal ulcers with a glowing squint-hook, whose point is covered with platinum. He succeeded in curing them by several superficial applications.

VÉRON (199) publishes the clinical history of several cases, showing the good results obtained by Saemisch's operation in severe cases of corneal abscess due to trachoma.

V. MITTELSTÄDT.

DENARIÉ (200) saw a patient with parenchymatous keratitis die of cerebral gummata. Infiltrations were found in the cornea, which Gayet declared to be gummous. MARCKWORT.

When parenchymatous keratitis and sclero-keratitis become complicated with iritis and local and general treatment have failed, CARBONÉ (202) advises iridectomy. MARCKWORT.

GALLENGA (203) reports that for many years iridectomy has been performed at the healthy corneal margin, at both sides of the scar, in cases of corneal staphylomas, in order to flatten them and diminish the irritation they produce. The result is the more certain, the more it is possible to detach the agglutinated iris and obtain an extensive free pupillary margin. The staphyloma becomes a smooth, solid leucoma, and the pericorneal injection entirely disappears. The two iridectomies must not be done at the same time, but with an interval of two to three weeks between them. In 54 cases operated in this manner, the great majority proved entirely satisfactory. DANTONE.

LINK (204) observed abscesses of the cornea in a scrofulous girl, besides others on the head and genital organs. They took a favorable course. The corneal abscesses healed, leaving only small central sores.

208. GALEZOWSKI–DAGUENET. Maladies de la sclérotique. Diagnostic et traitement des affections oculaires. Paris, 1883.

209. BETTMAN BOERNE. The operative treatment of episcleritis. *Weekly Med. Rev.*, March 17, 1883.

GALEZOWSKI and DAGUENET (208) instil atropine and eserine alternately in episcleritis also, as in abscesses of the cornea; a drop of eserine being given in the morning, and a drop of atropine in the evening. MARCKWORT.

The third section of the report will be published in the next number.

Dr. OLE BULL sends us the following communication:

Prof. PREYER having announced my chromatoptric chart in No. 19 of the *Deutsche Literaturzeitung*, I wish to add, with the consent of the editors, a few explanatory remarks.

Prof. Preyer says: "We have no guaranty that all the charts are alike, and the comparison of the results obtained with two

different charts is made illusory even by the varying intensity of daylight."

I must protest against this assertion. As explained in the text, the same pigments have been used for all the charts, inasmuch as all the squares have been cut from twice repainted plates.

It is true that some squares are lustrous, but this can easily be avoided by so placing the chart that the reflection disappears.

The majority of oculists, however, would hardly concur with Prof. Preyer in his assertion that pigments are not suitable for quantitative determinations.

MISCELLANEOUS NOTES.

Book Notices.

1. Otto Becker. **Zur Anatomie der gesunden u. kranken Linse.** (On the Anatomy of the Healthy and Diseased Lens.) Wiesbaden: I. F. Bergmann, 1883. Price mk. 36 ($9).

This quarto volume of 110 double-column pages, with sixty-six superbly executed drawings on fourteen lithographic plates, adds to ophthalmological literature a fundamental work on a subject which, though of the greatest importance, has hitherto been investigated with but very unsatisfactory results. While the treatment of cataract has for many years received the unswerving attention of all ophthalmic surgeons, and the operations for cataract are the pride of our art, the pathology of cataract, until recently, was almost a blank. O. Becker's present work, a supplement of his "Pathology and Therapeutics of the Crystalline Lens" in Graefe-Saemisch's Handbuch, will be studied by every ophthalmic surgeon, from the beginner to the most erudite and experienced practitioner, with delight and profit. The first chapter gives a clear, detailed description of the methods of anatomically investigating cataracts, and will be welcome to every operator who desires to verify and correct his diagnosis after each extraction, and to derive from a sure basis rules for guidance in future operations. The other chapters contain, in systematic arrangement, descriptions of the development, growth, and involution of the healthy lens; the morbid conditions found in the different parts of the crystalline body; its nutrition in the physiological and pathological states; and the general pathology and pathogenesis of cataract. The last chapter, almost half of the text, contains a detailed classi-

fication and description of all known forms of cataract, illustrated by numerous cases from the author's experience, and accompanied by many practical rules and suggestions. The older, but especially the newest, literature on the pathology of the lens, is fully, clearly, and critically discussed. At the end of the context are a bibliography and a description of the drawings. The drawings are, however, constantly referred to in the systematic part.

Authors of works like this not only advance science, but do a service to every practitioner by rendering his daily labor more gratifying and fruitful. Becker's treatise and atlas may be pointed out as a model for imitation, both to the experienced surgeon who is in full practice, and to the student who, at his hand, is introduced into the field of science. Becker, from his hospital and by his influence, procured the material of investigation, and directed the assistants of his clinic, Drs. J. R. Da Gama Pinto and H. Schäfer, how to work it up microscopically. The great majority of the microscopic specimens were prepared by these young men, and the drawings were made by special artists; the text, however, is written by the professor. Every one who knows how much time is consumed by the modern microscopic technique, will appreciate what a gain there is in such a division of labor. To American and English students of ophthalmology Becker's work may be specially recommended, as it not only gives them indispensable knowledge on a most important subject, but the author's clear and correct style will be very useful to them in learning German. The book cannot fail to stimulate and encourage original investigation. It furnishes an extensive and solid foundation for further research, but the author is too modest in saying: What I offer is only a beginning.

2. E. LANDOLT: **Réfraction et Accommodation,** with one hundred and ten figures in the text. This treatise of three hundred and twenty pages, to which about one hundred will be added to complete it, is the first part of the third volume of the Traité complet d' ophthalmologie, par L. de Wecker and E. Landolt, the French revised edition of Graefe–Saemisch's Handbuch. The German original of this division is rather incomplete; Dr. Landolt's treatise is for the most part independent of the German, and may be considered original. The subject is clearly and exhaustively treated, and the work can be highly recommended to the student and practitioner of ophthalmology. The well-known name of the author is a guarantee of its excellence.

Appointments.

Prof. STELLWAG VON CARION has been appointed to the Chair of Ophthalmology in the University of Vienna, in place of Prof. v. Arlt, resigned.

Dr. EDW. v. JAEGER, Professor Extraordinary, has been appointed Professor in Ordinary of Ophthalmology, at the same university.

Dr. J. A. ANDREWS, formerly Assistant Surgeon to the Manhattan Eye and Ear Hospital, has been appointed Attending Ophthalmic Surgeon to Charity Hospital, New York, instead of Dr. E. P. Ely, resigned.

(The Ophthalmic Division in Charity Hospital consists of a male and a female ward of thirty-two (free) beds each, with two small rooms for operative cases. There is no Dispensary connected with it. The annual number of inmates is nearly 500, of operations about 150. The published report of 1881 shows 14 iridectomies, 18 extractions, 12 enucleations, 39 operations on the lids, etc. The present staff consists of Drs. E. S. Peck, Richard Kalish, and J. A. Andrews, as Visiting Surgeons, and a number of internes. The service is not continuous.)

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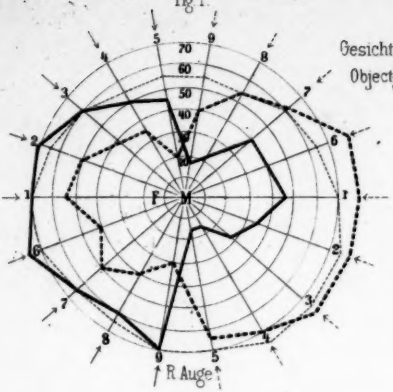
Fig 1.



Gesichtsfeld für Weiss
Objectgröfse 5 Mm²

Fig 2.

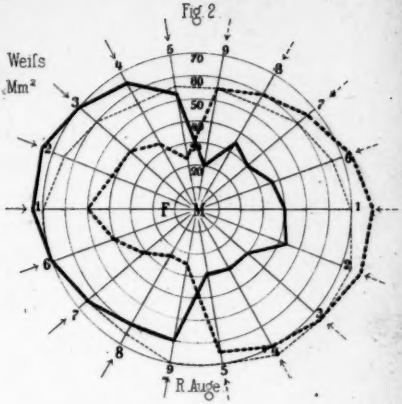


Fig 3.

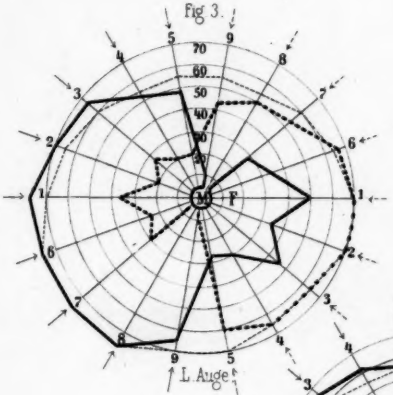
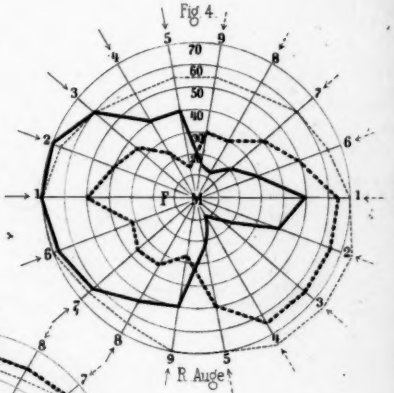


Fig 4.



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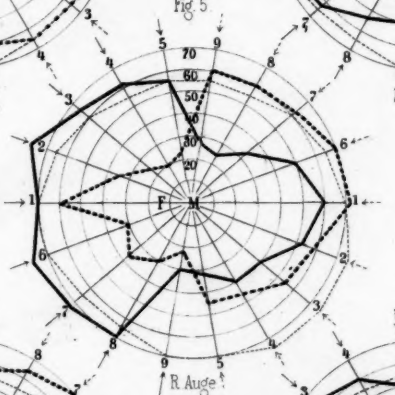
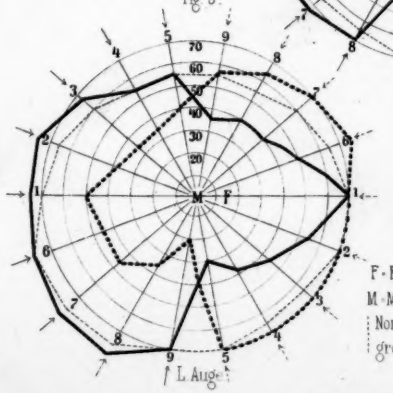


Fig 6.



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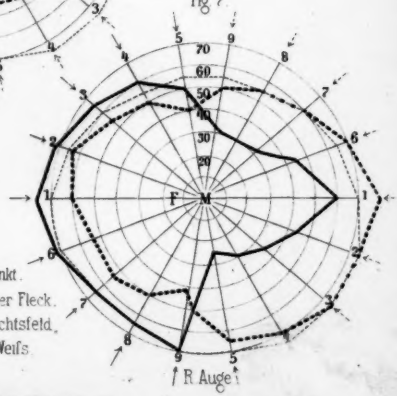


F - Fixationspunkt.
M - Mariottescher Fleck.
Normale Gesichtsfeldgrenze für Weiss.

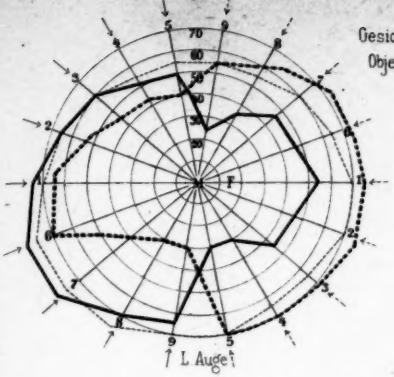
Verlag v. J.F Bergmann in Wiesbaden.

ARCHIVES OF OPHTHALMOLOGY III.

Lith. Anst. v. F. Wirtz, Berlin.

Gesichtsfeld für Weiss
Objectgrösse 5 Mm²

Fig 8



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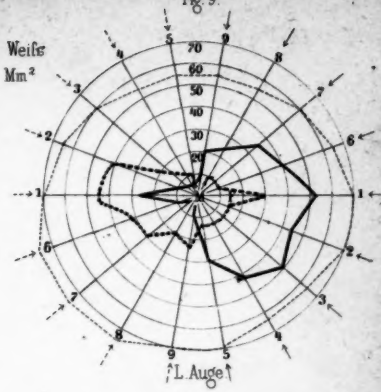


Fig. 10.

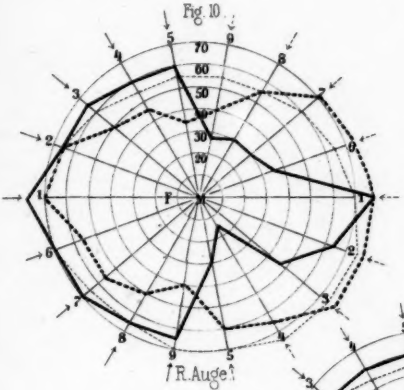
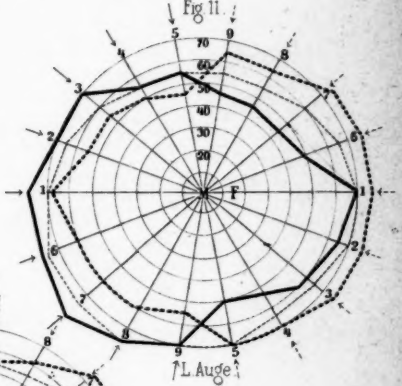


Fig 11.



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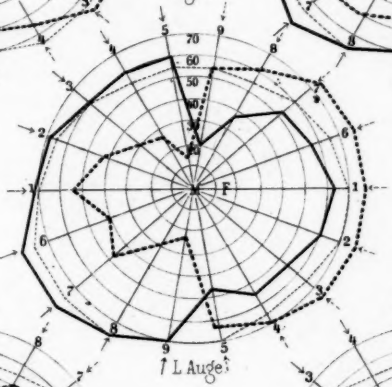

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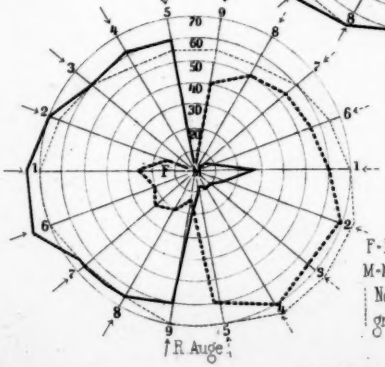
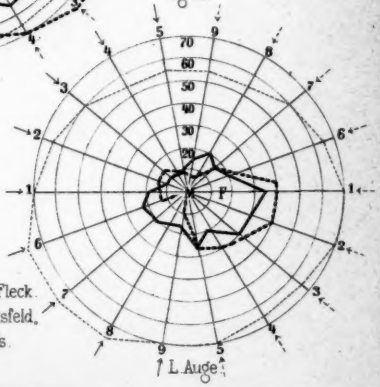


Fig 14.



F = Fixationspunkt.
M = Mariottescher Fleck.
Normale Gesichtsfeldgrenze für Weiss.

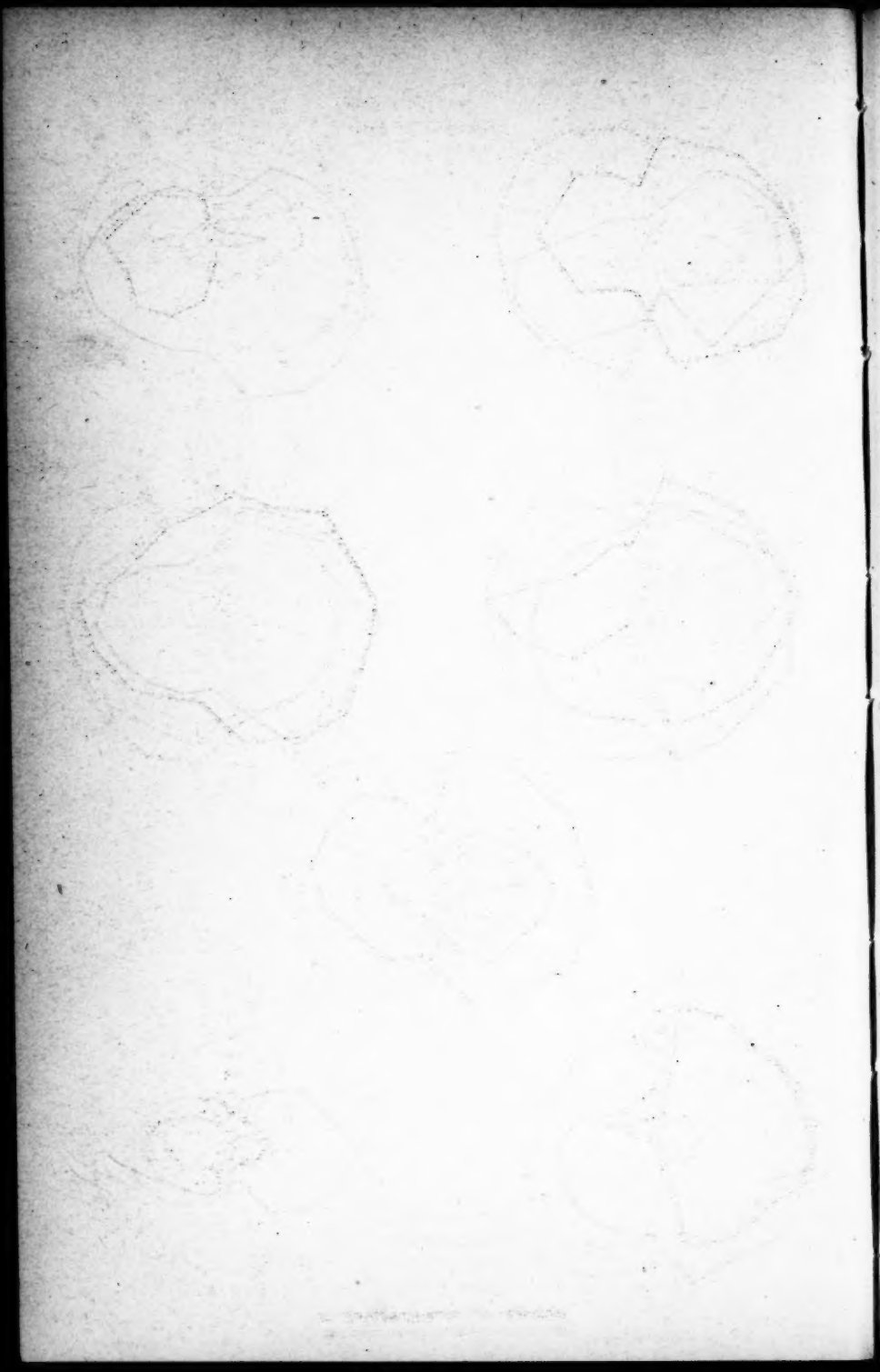
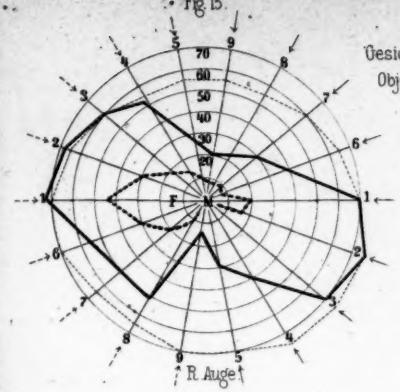


Fig. 15.

Fig. 16.

Gesichtsfeld für Weiss
Objectgrösse 5 Mm²



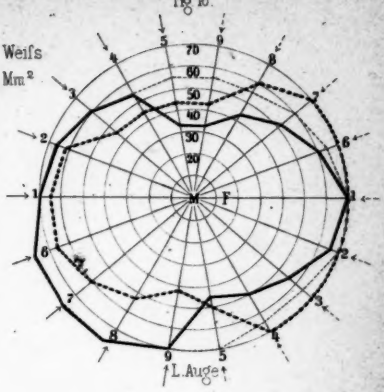


Fig. 17

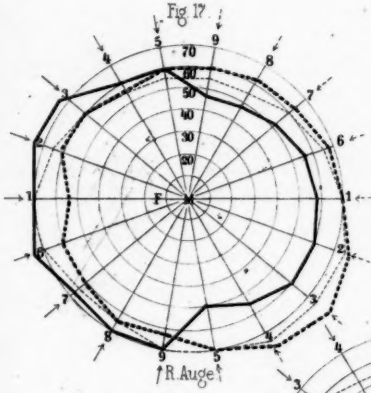
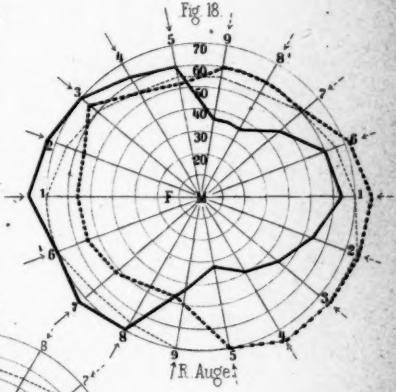


Fig. 18.



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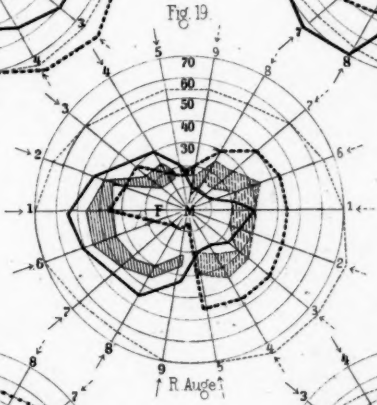
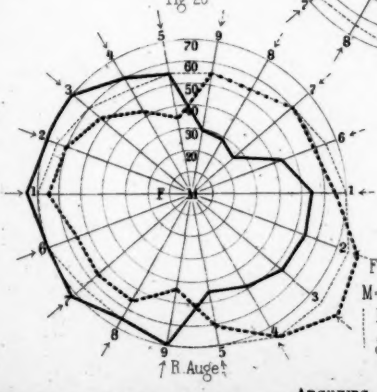


Fig. 20



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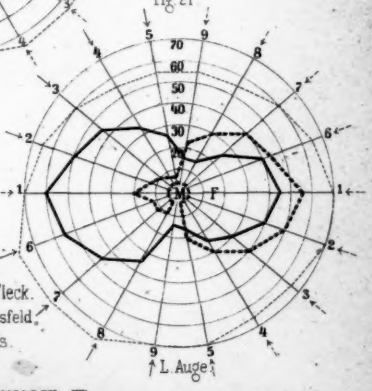


F = Fixationspunkt.
M = Mariottescher Fleck.
Normale Gesichtsfeldgrenze für Weiss.

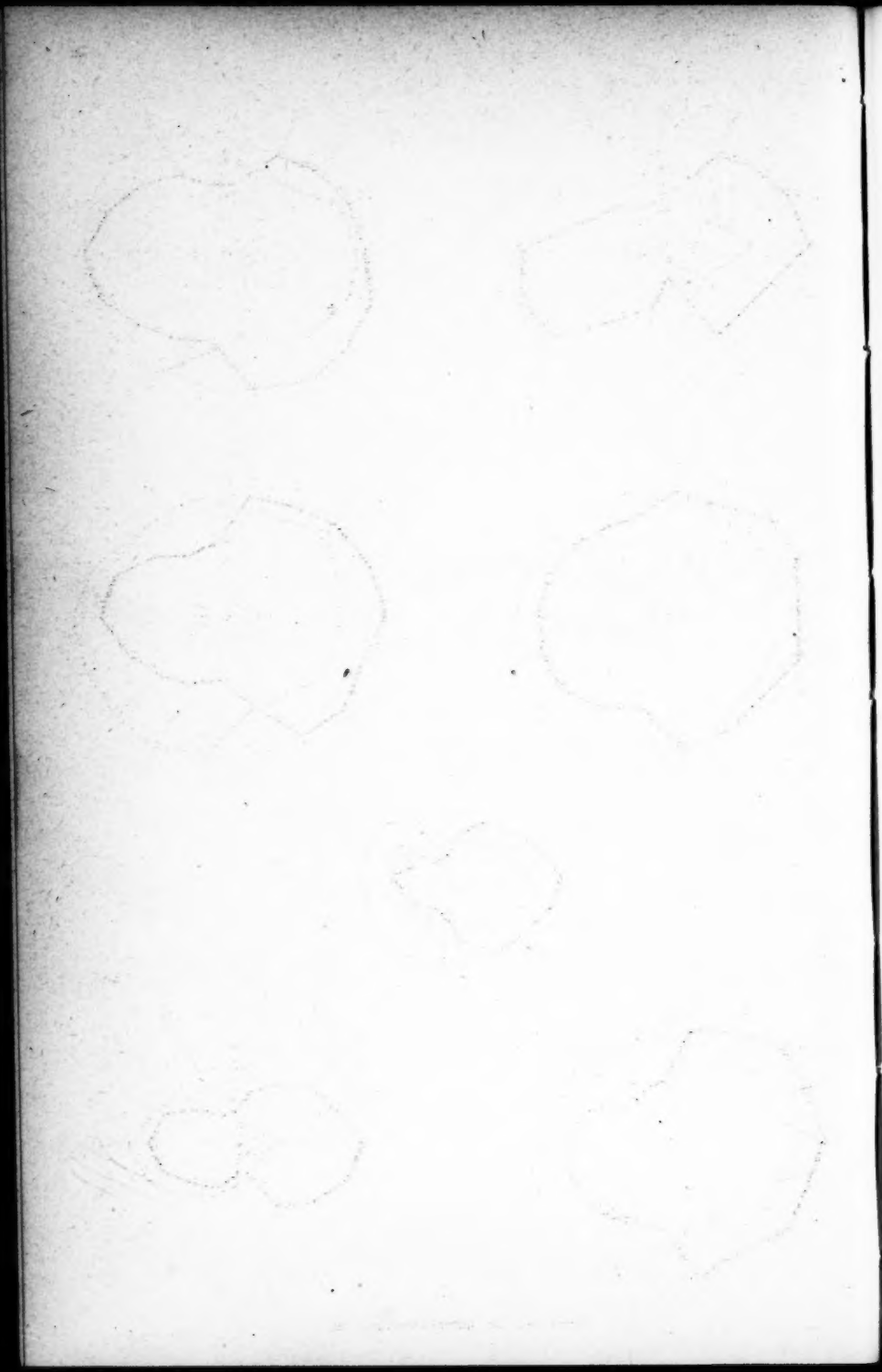


Fig. 1.

Fig. 2.

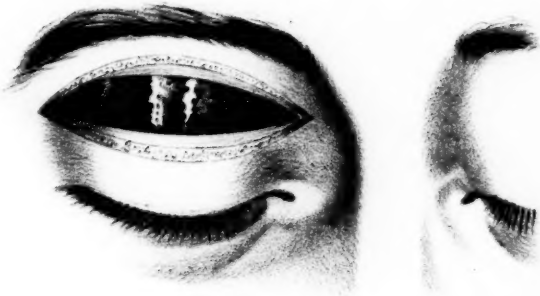
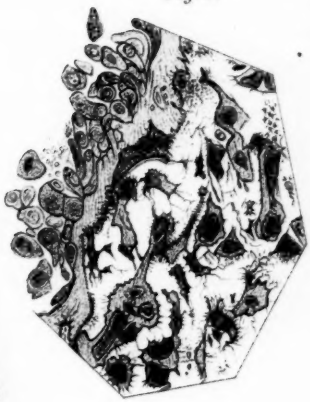


Fig. 3.

Lith. Anst. v. Werner & Winter, Frankfurt a/M.

Fig. 4.

Fig. 5.



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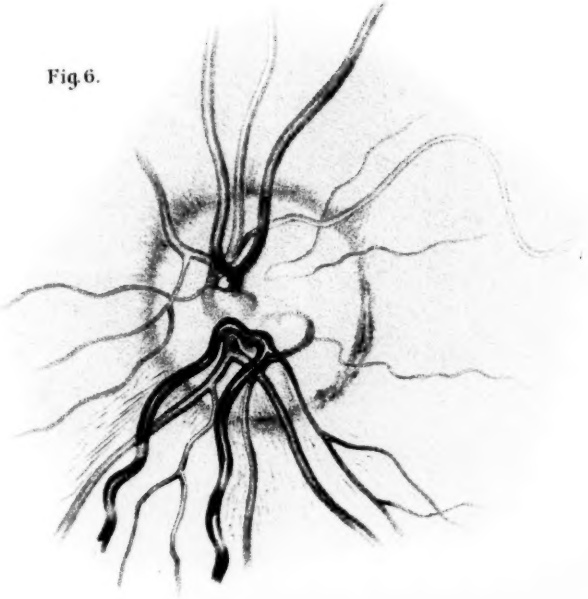

Lith. Anst. v. Werner & Winter, Frankfurt a/M.

Fig. 1.
R. A.

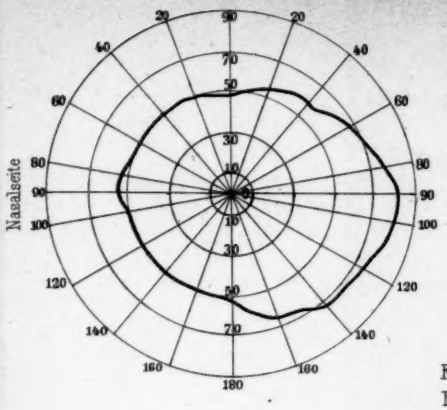

Fig. 2.
R. A.

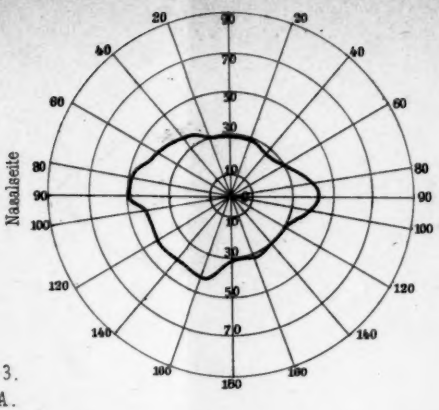

Fig. 3.
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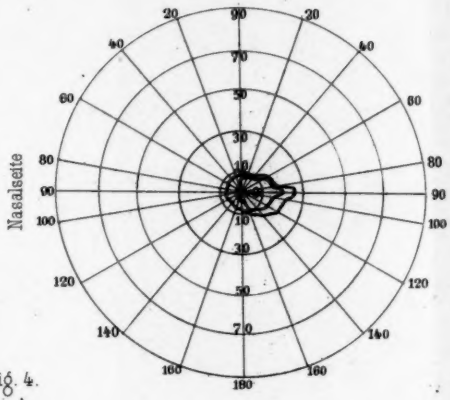

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R. A.

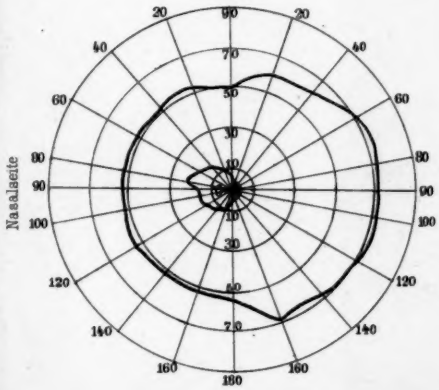
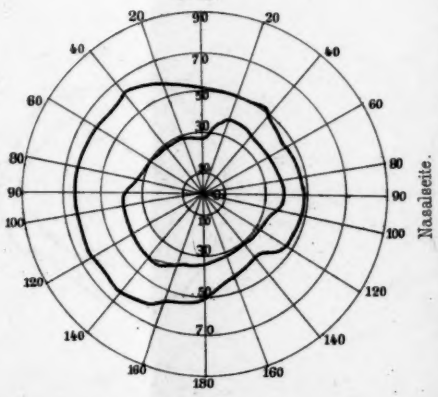
Fig. 5.
L. A.